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ELECTRICAL IRRIGATION WORKS.

One of the most interesting and characteristic uses of electric energy to be found in our Western country is the pumping of water for irrigation by motor-driven pumps. A paper by Mr. E. A. Wilcox in this issue gives a striking report of actual accomplishments along this line in the arid territory of southern Idaho. This great American desert, which in our grandfathers' geographies reached from the Missouri to the Coast Range, has gradually narrowed its limits and may now be described as a strip of very fertile country which suffers from sub-normal rainfall. Experience with irrigation soon showed its value, and wherever there is a good available water supply the ditch companies have done their work well. It has remained for very recent years to show the immense value of the motor-driven pump to the farmer in rendering available the water sources at his very doors which did not admit of utilization by the ordinary gravity distribution. As experience with irrigation has grown it has been found that the supply of just enough water, for different crops, is rather a fine art, that different soils require greatly varying amounts of water, and that if used skilfully the actual amount of water needed is small. Hence with every such increase of knowledge pumping for irrigation becomes more and more practicable.

Mr. Wilcox describes the extension of irrigation work as part of the development of several of the big electrical transmission systems in the arid district. It has been found in general that it is wise to use fairly large pumping installations, taking care of considerable land but yet not so extensive as to make the distribution difficult. While the older data on water requirements called for a depth of 4 ft. or more annually, recent tests show that a modest fraction of this is sufficient for most crops and soils. The demand for water runs chiefly over the six months from April to September inclusive, more than a half of the total requirements falling in June and July, so that from the standpoint of electrical supply the load is a midsummer one. As most of the pumping is done in a fairly large way and pumps are used pretty steadily in the dry season, the diversity is near unity. It has been found that the load-factor in such work is a little better than 0.5. In charging for energy the bill is based on the consumer's highest half-hour peak, as shown by a recording meter, the price being quite commonly $20 per hp of this peak for the whole season of six months. This figure has been found low enough for competition with gravity supply at ordinary rates, and it is fairly remunerative to the stations. Owing to the increase in this summer pumping load, the utilization of the installed generating equipment in winter has proved somewhat of a problem. This has been, in part at least, met by encouraging the use of electricity for general heating purposes. The heating load is taken on at a flat rate, generally varying with the

size and character of the installation, and the net result is that the heating of homes, offices and stores is being accomplished as a winter load in a territory where the usual winter lighting peak could not begin to equal the excess output shown in summer by the irrigation load. Altogether the motor-pumping scheme seems to have worked out well for all parties concerned. It opens to agriculture great regions otherwise useless, furnishes a large and profitable load for low-priced energy on a large scale and opens the way for a heating load on a scale hitherto untried.

STEEL-MILL LIGHTING.

When one can start with a new building having no structural peculiarities and used for ordinary manufacturing purposes the task of designing the illumination installation is a very simple one. The practical conditions in a steel mill are very far indeed from this ideal simplicity. In general the problem is to light a large, high building grimy with dust, hazy with smoke and obstructed by heavy machinery and a huge traveling crane. In addition the yards must be well lighted, and especially good illumination is required in inspection and office rooms. As to general methods, Mr. B. G. Beck, in an article elsewhere in this issue, finds that the main facts indicate the desirability of installing lamps placed well above the crane and all other local obstructions and supported from the roof rather than from the walls. This plan leads rather naturally to the use of powerful units equipped with reflectors, necessitating trimming or renewals at somewhat infrequent intervals. The very obvious difficulty of interference with illumination by the crane has been happily met by simply providing the crane with a powerful lamp, thus removing its own shadow as it goes along.

One interesting fact brought out by Mr. Beck is that in determining the illumination for this kind of work the best method is the old reliable point-by-point scheme worked out from the polar candle-power curve of the lamp. The reason for this is that the conditions are far from uniform over the space considered and the real problem is not to obtain a sufficient average but enough light at the darkest points wherever they may be. Generalized methods of computation are suited only to generalized requirements—a fact too often overlooked in arranging artificial lighting. As to light sources, Mr. Beck has little to say in recommendation of particular things, but his requirements suggest strongly the use of the yellow long-burning flame-arc lamp. He has a good word, however, for the large tungsten lamps as giving long life, although obviously the necessary cleaning of the globes is as much of a nuisance as is the trimming of an arc lamp. The incandescent lamp withstands fumes that would soon put an arc lamp out of commission. One of the rather striking features of steel-mill practice is that the plant can roughly be divided into two parts, one requiring very little light and the other a great deal of light. Over most of the area less than half a foot-candle suffices, while in places requiring materially more than this there must be almost eight or ten times as much. The peculiarities of this nature call for real skill on the part of the illuminating engineer. Formerly in steel mills dependence was placed in large part on the light from the hot metal, but the exacting requirements of modern industry now demand methods of precision in many things and call for every aid toward this end that can be obtained at practicable cost.

THE NORTHWEST STATION.

The article by Prof. H. H. Norris on the Northwest station of the Commonwealth Edison Company of Chicago treats a subject already familiar to readers of technical literature. The station possesses many ingenious features and the hugeness of the project impresses one with the strides made in central-station practice within the past few years. In this station we have an excellent example of a system planned with an eye single to every detail conducive to efficiency and reliability, and as such it is worthy of close study by all engineers engaged in central-station work.

There is one feature wherein the Northwest station differs from the usual central station and wherein it is worthy of emulation by even the smallest property in the country, and that is the beautification of the grounds surrounding it. A power house need not look like a palace; neither need it resemble a squatter's shack. Germany abounds with numerous steam stations that are architectural gems, and even prosaic America possesses many water-power stations that are a pleasure to behold. Where stations are located within city limits it is due the community that the site shall not be an eyesore, and in large cities this debt to the citizens is being recognized. It is surprising what a little patch of green and some shrubbery will do to cover up the baldness of what must of necessity be a homely structure until the advent of that master mind who can convert a common iron smokestack into a thing of beauty and take away the unsightliness from a black coal pile.

ILLUMINATION AND VISION.

A tendency of much public importance noted in connection with the papers and discussions at the recent Illuminating Engineering Society convention is the increased amount of attention being given to a study of illuminating conditions which are most comfortable for vision and favorable to the conservation of good eyesight. The importance of investigating this subject has been appreciated for some time by many of those who are trying to design artificial lighting, but knowledge on the subject has heretofore been extremely general rather than specific. For example, it is known that under certain conditions very bright light shining in the eyes interferes with clear vision and causes eye strain. When it comes to applying these and other principles connected with vision to actual lighting design, however, there is little definite information. To obtain such information requires research by scientific investigators along physiological and psychological lines, as well as experiments by engineers. The papers and discussions at the last convention indicated that within another year the data on this important subject will be greatly increased; in fact, the collection of information has already been largely increased by the preliminary researches reported in the convention papers.

The research conducted by Dr. P. W. Cobb showed that at the ordinary working intensities of artificial illumination and wall brightness there is very little difference in the visual acuity amid light surroundings as compared with dark surroundings. Greater visual acuity was shown with bright surroundings than with dark surroundings when the illumination of the test object upon which the eye was working was increased beyond a certain point. This point is within the upper ranges of commercial practice. In the discussion good authorities called attention to the confirmation these results have in practical experience. Constant work with the eye fixed on a highly illuminated object with dark surroundings is extremely tiresome and causes discomfort.

An important suggestion as to a method of investigating eye fatigue was made in a paper by Prof. C. E. Ferree. In this method, which promises valuable results, advantage is taken of the fact that when the eye is steadily fixed on some object which is barely distinguishable there come periods when the object is blurred, and these periods occur more frequently and for a greater percentage of the time the greater the previous eye fatigue. Professor Ferree tested subjects in this way by having them record the blur periods before and after working under given conditions of lighting for a number of hours. The preliminary results published show a striking difference in the fatigue under natural lighting as compared with an atrocious example of direct lighting. Now that the interest of psychologists has been attracted to this subject, more rapid advance may safely be expected. Among other contributions to the knowledge of lighting conditions favorable to vision brought forth by the convention should be mentioned the postal-car lighting tests informally reported by Mr. A. J. Sweet, which confirmed certain evidence presented at the 1911 convention as to the importance of avoiding glare or specular reflection from a reading paper. Glare from paper appears as a disturbing factor in easy vision, even though the paper has an apparently unglazed, matt surface.

THE ELECTRIC VEHICLE AND THE CENTRAL STATION.

One of the most prominent groups of exhibits at the electrical show now being held in Boston is that of electric vehicles of various models. Vehicles of numerous types have been displayed at practically all electrical shows during recent years, so that the present exhibit marks no new departure in this respect. However, one cannot fail to note the ever-increasing tendency on the part of electric-vehicle manufacturers and users to appreciate the need for healthy co-operation with central-station men and the increasing appreciation on the part of central-station managers of the desirable character of vehicle-battery charging as a load on the stations. No more appropriate place and time could have been selected for the convention of the Electric Vehicle Association of America than Boston during the electric show, and it is safe to predict from the very evident increasing co-operation between the electricity supply and electric-vehicle men results highly satisfactory to both of these interests.

ELECTRICAL PROPERTIES OF INCANDESCENT LAMPS.

Reference is made in the *Digest* to an article by Dr. H. Pecheux which brings together much information concerning the electrical properties of incandescent lamps. One of these properties is the ratio of the working normal resistance of a lamp to that it possesses at zero Centigrade, or, in other words, the ratio of its ohms hot to its ohms cold. The precise value of this ratio depends, of course, not only on the material of the filament but also on the particular temperature at which the filament is operated when incandescent. However, for lamps in practical service the ratio has a definite value and is of practical interest. It is well known that in the case of carbon filaments the resistance hot is much less than the resistance cold. The ratio is not the same for graphite and for gaseously deposited or treated carbon. But the working resistance of the ordinary carbon incandescent lamp is well known to be about one-half when hot of what it is when cold. In the article the ratio is given as in the neighborhood of 0.6 for the particular carbon lamps investigated. In the case of metallic-filament lamps the conditions are reversed; that is to say, the resistance hot is much greater than the resistance cold, following the well-known rule of metallic conductors. Thus the article gives a mean ratio of 7.4 for tantalum-filament lamps; so that the normal resistance of the tantalum lamps tested when hot averaged 7.4 times as much as their resistance at zero Centigrade. For tungsten-filament lamps the ratio given is still higher, the average being a little over 15. In the case of a pair of zircon-tungsten lamps the ratio was 11.36.

The effect of the ratio is very marked on the initial rate at which energy is liberated in a lamp filament when the current is turned on to it. In the case of a carbon filament the initial watts when turning on the current are only about half the final watts when the temperature has become steady. On the contrary, in the case of a tungsten filament the initial watts are fifteen times as great as the final watts. This means that the initial rate of increase of temperature is much greater in a tungsten than in a carbon lamp; nevertheless, the rate of lighting up is in all practical cases so great that it is hard to distinguish, with the unaided eye, the greater swiftness of incandescence in the tungsten lamp.

The article brings out also the well-known and important differences between different types of filaments in regard to their candle-power as affected by voltage. In the case of carbon lamps the candle-power in the vicinity of normal voltage varies usually in the neighborhood of the fifth or sixth power of the voltage; so that if the voltage rises say 1 per cent above normal, the candle-power rises say 5.5 per cent. The corresponding power of the voltage is less in all of the standard metallic-filament lamps. Thus, the article gives the power for tantalum as about 4 and for tungsten as about 3.9. Consequently, if the voltage at the terminals of such a tungsten lamp rises 1 per cent above normal the candle-power rises only 3.9 per cent. This is a very valuable advantage of the tungsten as compared with the carbon lamp, since the inevitable small variations of voltage that are bound to occur on incandescent lighting mains produce only some two-thirds as much fluctuation in tungsten lamps as they would produce in ordinary carbon lamps.

PROGRAM OF NEW ENGLAND SECTION CONVENTION, N. E. L. A.

Arrangements have been completed for the forthcoming convention of the New England Section of the National Electric Light Association at Boston on Oct. 15-17. The meeting will begin at 10 a. m. Oct. 15 with the address of President J. S. Whitaker, of Portsmouth, N. H., and the following papers will be read during the convention: "The Education and Welfare of the Employee," by Mr. A. S. Nichols, Woonsocket; "Electric Protective Devices," by Mr. C. C. Badeau, Boston; "The Relation of the Central Station to the Prospective Consumer," by Mr. E. M. Addis, Brattleboro; "Transmission Line Construction," by Mr. R. D. Coombs, New York; "The Development and Application of Electricity to Agriculture," by Mr. C. H. Miles, Boston; "Illuminating Engineering for the Central Station Salesman," by Mr. R. Beman, Cleveland; "Co-operation Between the Central Station and the Motor Manufacturer," by Mr. J. M. Tomb, Boston. The social program includes a dancing party on Oct. 15 in Paul Revere Hall in the Mechanics' Building, where the convention sessions will also be held. The election of officers will take place on Thursday afternoon, Oct. 17, and in the evening the annual banquet will be held. The headquarters of the association during the convention will be at the new Copley Plaza Hotel. All members of the national body have been invited to attend. The entertainment committee consists of Messrs. R. W. Rollins, Worcester, Mass., chairman, and Messrs. S. J. Lent, C. B. Burleigh, W. C. Dronet, H. M. Savage, B. M. Bates, H. T. Sands and W. E. Holmes. Miss O. A. Bursill, Boston, is secretary of the New England Section.

ELECTRIC-VEHICLE ACTIVITY IN CHICAGO.

In Chicago all persons connected with the electric-vehicle industry, whether as manufacturers, dealers, central-station operators or garage owners, appear to agree that the industry is in an active and flourishing condition. The newly organized Chicago Section of the Electric Vehicle Association of America has started to work with enthusiasm, and it exemplifies the excellent degree of co-operation to be observed among the various parties at interest in the great Western city. The Commonwealth Edison Company is active in promoting the electric vehicle in many ways. It advertises in the daily newspapers and issues literature on the subject, the most recent contribution being a map showing the location of public charging stations for electric vehicles in Chicago. The services of the company's experts are always at the disposal of garage owners and independent proprietors of electric cars, and the company takes pains to co-operate in every movement tending to increase the use of the vehicle. It believes that the charging of batteries for automobiles is a desirable central-station load, and by means of its recently devised off-peak schedules for both alternating-current and direct-current energy it makes very low rates for energy available for this class of business. The company encourages the public garage owner to resell electricity to vehicle owners at a profit, and for this purpose rents individual meters for vehicle charging in garages at a rate of 50 cents a month.

One of the aids in electric-vehicle operation distributed by the Commonwealth Edison Company consists of a card 5 in. high and 3 in. wide bearing two printed dials each 1.75 in. in diameter and reading from 0 to 9. The dials are provided with movable pointers and the purpose of the card is to be of assistance in keeping a record of the amount of electricity used in charging the vehicle battery. When starting to charge the operator sets the pointers on the card in the same position as the pointers on the two dials on the right-hand side of the watt-hour meter used. When the battery is charged it is easy to compare the position of the pointers on the meter dials with the original position as shown by the pointers on the card. This saves the trouble of making a written memorandum of the original position of the meter dials.

In all there are perhaps 100 public garages in the city and immediate suburbs where electric charging facilities are available. Of these perhaps half a dozen are exclusively for electric vehicles. The largest of these is the Fashion Garage, on the South Side, which has recently purchased an acre of ground at the corner of Hyde Park Boulevard and Fifty-first Street and will here erect an exclusively electric garage having accommodations for no less than 300 vehicles. The off-peak schedules permit the garage owner under certain conditions to purchase electrical energy at as low a rate as 2 cents or 2.5 cents a kw-hr. It is therefore possible to resell this energy at the moderate rate of 4 cents, permitting the garage owner to make a profit.

EXTENSION TO FISK STREET STATION, CHICAGO.

It is reported that the Commonwealth Edison Company has awarded the building contract for the addition to its Fisk Street station in Chicago to the Falkenau Construction Company. This addition will house the 25,000-kw Parsons horizontal turbo-generator now under construction for the Chicago company at the Heaton works of Charles A. Parsons & Company, of Newcastle-on-Tyne, England. As related in the *Electrical World* of March 23 last, this unit is being built from designs made by Sir Charles A. Parsons, who is also superintending its manufacture. It will be about 75 ft. long and 18 ft. wide, and the steam turbine will be a two-chamber machine, the low-pressure end being of the double-flow type. The generator will be wound for 4500 volts, three phase, 25 cycles, and will have a speed of 750 r.p.m. The exciter will be placed at the end of the shaft. Sargent & Lundy, of Chicago, are the American engineers in charge of the design of the general arrangement and the coal-handling and steam-raising equipment at the new addition to the Fisk Street power house.

The addition to the plant now under contract will be large enough to house four 25,000-kw units, although only one of these has been ordered. As the present rating of the station (ten 12,000-kw vertical turbo-generators) is 120,000 kw, the addition, when completed, will bring the total rating of the plant up to 220,000 kw. Work will be begun for the new building at once, but it will be several months before the new unit, which will be the largest in the world, will be shipped to this country, erected and placed in service.

ORGANIZATION OF ELECTRICAL CO-OPERATIVE ASSOCIATION.

As we go to press (Oct. 3) the committee composed of representatives of the National Electric Light Association, the Electrical Supply Jobbers' Association, the National Electrical Contractors' Association and of several of the electrical manufacturers that was formed at Association Island, Lake Ontario, on Sept. 3, as noted in the *Electrical World* Sept. 7, page 483, to create a co-operative association for the benefit of these various electrical interests, is holding its organization meeting at the Engineering Societies Building, New York. The business which will be transacted will be the discussion and preparation of incorporation papers for the proposed association, the methods of financing it and the selection of a name. If time permits the election of directors and officers and discussion of the work which it is hoped will be accomplished by the association will also be taken up.

SAN FRANCISCO'S TRANSPORTATION PROBLEM.

In preliminary report No. 9 on his investigation of the transportation conditions in San Francisco, Mr. Bion J. Arnold discusses some of the principal factors involved in the solution of the problem of transportation at the present and in the future. He states that if the prevailing rate of growth continues San Francisco in 1925 will be the center of a district community of 1,400,000 persons, or 600,000 persons within the city proper, from which $16,000,000 per year will be paid into the coffers of the railway company alone. Inasmuch as the daily trans-bay commuter traffic is fully 23 per cent of the population of San Francisco, the results in earnings per capita are as high as $20, as against about $12 for the average American city of moderate size. This fact constitutes the one prime source of optimism regarding the city's future development. The earning capacity is available. It only remains to develop a transit policy commensurate to the opportunity and to execute this policy with courage and dispatch.

Mr. Arnold states that at the present time San Francisco absolutely requires a large increase in transportation facilities, but the fact exists that under the conditions that have been imposed, in the hope of immediate results, no doubt, not one foot of extensions may be expected from private capital An attempt might very well be made at this time to clarify the franchise situation and relieve the city streets of present questionable franchise encumbrances by a new blanket agreement in the form of a co-operative contract-franchise. In the new city charter and the contemplated amendments thereto conditions are imposed which practically debar private capital from investment in San Francisco, whether the point of view of the capitalist is reasonable or not. These charter provisions and the underlying theory with respect to private capital will have to be modified, or else it is incumbent upon the city to buy its utilities at once at a considerable premium.

Mr. Arnold makes three recommendations concerning steps to be taken to remedy existing conditions:

First, the charter may be amended so as to make private investment possible.

Second, present corporate franchises may be merged on some equitable basis of equalization, with extension franchises desired.

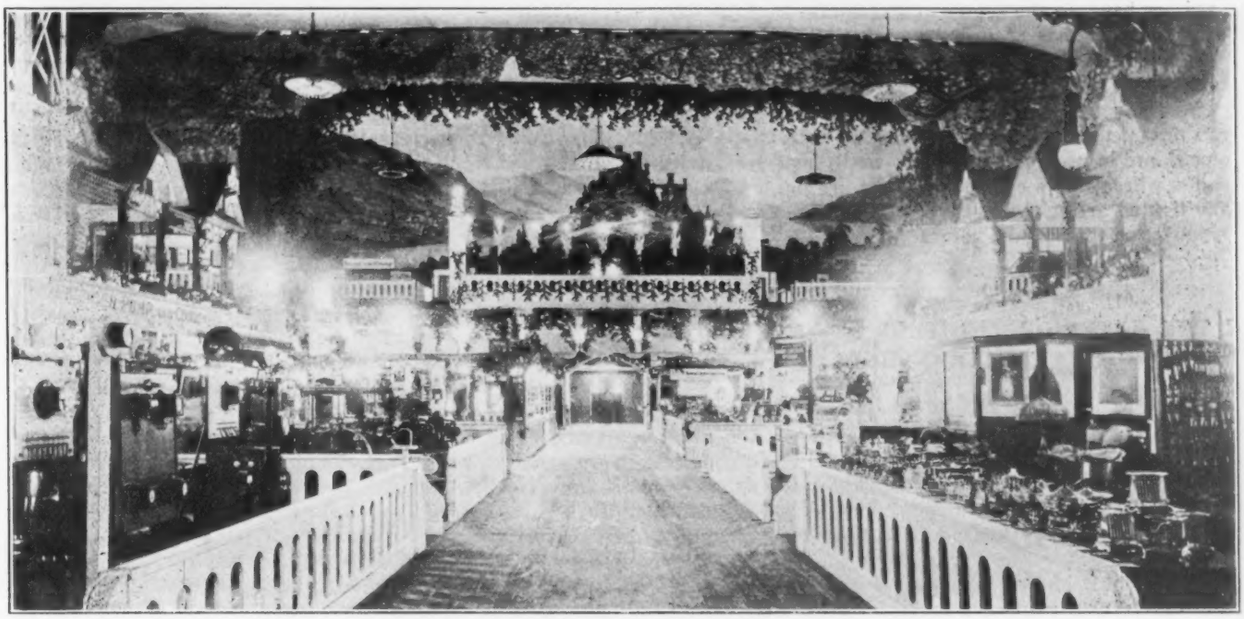
Third, duplication of investment may be avoided by non-competitive extensions, with the object of ultimate unification of the entire property at the lowest possible investment cost.

He argues that the question of a sane, reasonable and workable franchise agreement between the city and the United Railroads is the first great matter to be settled, to which all others are subordinate, and no time should be lost in formulating a plan for submission to the voters in November.

BOSTON ELECTRIC SHOW.

The Boston 1912 Electric Show was opened by the Edison Electric Illuminating Company of Boston on Sept. 28, the climax of two years' preparation being reached when the doors of the Mechanics' Building swung inward to welcome several hundred delegates attending the Fifth Congress of the International Chambers of Commerce, several hours before the general public was admitted. Nearly every square foot of exhibit space in the building is occupied by displays almost unparalleled in numbers and unequaled in variety in any previous show, and fully 40,000 persons passed the entrances on the opening evening.

An outline of the exhibits and a description of the exterior lighting effects secured are printed elsewhere in this issue. The interior lighting and scenic background provided successfully cover every structural detail of the building, and the use of curtains at all windows to exclude daylight enables the visitor to study the lighting effects at all times. Despite the irregularities of every section of the building, a consistent scheme of interior lighting has been effected under the designs of Dr. Louis Bell, consulting illuminating engineer of the Boston Edison company, who was responsible for the general outside and inside lighting plans of the entire show.



Central Aisle of Exhibition Hall, Looking Toward Band Stand.

The lighting of the exhibition reaches its height in Grand Hall, a large central area bordered on three sides by galleries, a stage on the fourth side being occupied by a castle of medieval architecture. The galleries on two sides are occupied by sixteen shelter houses of German design, while the exhibits flank a main aisle and four side aisles extending through the hall. The general lighting of middle aisles is secured by ten large bronze lanterns mounted on pedestals 14 ft. high, each containing a 500-watt frosted

lamp. The lanterns are of prismatic glass and are frosted inside and out.

Around the front of the balcony at about the same height are carried fifty ornamental lanterns suspended from brackets and provided with glazed prismatic panes alternating pink and green in color. Each lantern contains a 250-watt dipped lamp, and around each unit artificial foliage and electric flowers have been tastefully draped. The balcony houses are each equipped with a 60-watt lamp in a 7-in. ground-glass globe, the attics being provided with a 40-watt lamp suspended to shine through stained-glass windows.

About 5 miles of decorative cable lighting, aggregating 25,000 lamps of 150,000 total candle-power, is used in the interior illumination of Exhibition Hall, beneath galleries and in basement aisles. In general, the structural bays are followed with diagonals of 4-cp units festooned between the corners and a central pinning unit composed of a shaded 400-watt lamp, except in a portion of the basement, where the reduced spacing of bays enabled 250-watt units to be used. Under the balconies of Grand Hall the decorative cable is pinned with shaded white 250-watt lamps. Red effects are required, clear lamps being used over most of the aisles and show spaces of Exhibition Hall and the basement. The same general plan is followed in corridor and lobby lighting. About 200 cp in decorative cable units are used per bay. In the center of Exhibition Hall the electric vehicle exhibit has been laid out in an artificial park surmounted by an elaborate canopy of red and green decorative cable strings festooned between the surrounding balcony edges and a crown of 4-cp colored lamps at the top. About 100 ornamental brackets, carrying 40-watt lamps in 6-in. globes, are in use and on posts 60-watt lamps are carried at points where single ornamental units are needed. Electrically lighted artificial flowers are widely used and all backgrounds are painted in natural scenery.

THE EXTERIOR LIGHTING OF THE BOSTON ELECTRIC SHOW.

By Dr. Louis Bell.

The problem of suitable exterior lighting for the Boston Electric Show involved two entirely separate considerations, first, the external decoration of the building itself and, second, the decorative lighting of the street on which the building is located. The two necessarily formed, however, part of the same general scheme and finally were in the and green festoons are supplied where special decorative course of events still more closely associated, owing to

Fig. 1—Mechanics' Building, Boston.

considerations which arose quite accidentally. The fundamental idea in laying out the lighting as a whole was the free use of color as a decorative element, a thing generally neglected in exposition lighting. The evolution of the present arrangement from the preliminary studies is not without interest, as showing how such schemes have to be modified in order to meet conditions which have nothing to do with the decorations as such. The first preliminary plan included rather complete outlining of the entire building with incandescent lamps, with decorative effects in color. The building itself, about 600 ft. in length, is practically a long right-angled triangle in shape, terminated by a tower with entrance and porte-cochère on the east, with the base lying along West Newton Street on the west and the hypothenuse on the rear of the building along the Boston

Fig. 2—Huntington Avenue and West Newton Street Sides of the Building at Night.

and Albany Railroad yards and over them facing Boylston Street. On the front of the building are three entrances. the main façade and entrance lying near the western end, the tower forming the eastern entrance, and the third entrance being practically in the center of the building along the front, connecting the main building with the tower. Fig. 1, the front of the building, shows the general arrangement, consisting really of a building in three united portions, each with an entrance necessarily treated in a scheme of decoration.

A large part of the front is heavily covered with ivy, the growth of many years, and this could under no circumstances be interfered with or imperiled by the decorations. Moreover, the owners of the building were insistent that no bolts or spikes should be fixed in the wall, so that the problem of supporting the decorations became an exceedingly trying one. Exposition buildings are ordinarily temporary and permit of any means of attaching decoration that seems desirable, and therefore the requirements in this case presented unique difficulties. The general plan of decoration was also modified later by a change in the design of the street illumination.

The Mechanics' Building faces on Huntington Avenue. This street terminates on Copley Square, the most important square in the city, and runs westward across Massachusetts Avenue, the natural terminus of decoration on the west end, a distance of about 3000 ft. The outside problem, therefore, resolved itself into beginning a consistent lighting scheme at Copley Square and continuing it to Massachusetts Avenue. At the outset the plans contemplated a great arch spanning the whole width of the avenue at its entrance into Copley Square and elaborately ornamented with electric lamps. Beyond this the street was to be brilliantly lighted

with arc lamps for its entire length. At that time the "Boulevard" magnetite arc had not come into use and it was somewhat doubtful whether it would be put out commercially prior to the Electric Show. The first arc-lighting scheme, therefore, was intended to be carried out with these beautiful lamps, carried on tall ornamental poles and leading from the entrance arch at one end and from a pair of elaborately decorated pylons at the other to the Mechanics' Building. The early appearance of the boulevard arc lamp in commercial use, however, which robbed it of the element of novelty, and the structural difficulties connected with the arch, which required a span of 70 ft., led to the abandonment of this particular design.

Fig. 3—Illumination of Main Entrance.

It was followed by a comprehensive scheme based on the use of Elblight cable, including a long succession of arches supported on steel cables stretched between 50-ft. poles with much supplementary decoration, also carried out with Elblight. This plan, like the other, was worked out almost to the point of letting contracts for it, and, as a preliminary, arrangements were made for the use of practically all the Elblight cable in the country. At the last moment difficulties connected with the necessary permits and rights-of-way for the extremely elaborate plan in view compelled somewhat regretfully a complete change of base at so late a date that use had to be made of the immense quantity of Elblight cable provided. The natural expedient was to transfer this cable to the decoration of the building, but the owners would not permit it on the front on account of the ivy, so that a composite decorative plan had to be adopted. The front of the building was, therefore, treated according to the original scheme, and some 2 miles of the available cable was then devoted to draping the rear and the West Newton Street face.

The chief matters from the standpoint of decoration were the main entrance on the west and the tower entrance. The whole façade of the building is outlined with 4-cp incandescent lamps, for the most part uncolored, except along the roof line, where the lamps are light red or amber. Then, seizing on the architectural features of the façade containing the main entrance, its chief lines were outlined and the main architectural features were treated with mosaic decorations in color, conventionalized flowers and foliage. The whole effect at night is shown in Fig. 2. The colors used are dark green, light green, dark and light red and amber, the dark lamps being of 8 cp and the lighter lamps of 4 cp. Advantage was taken of the psychological effect of this diversity of color to secure an element of relief which otherwise would not have been present. Two huge blank spaces, about 5 ft. by 10 ft., flanked the main entrance below the entrance arch, spaces customarily used for billboards. These, as the illustration shows, were transformed by falsework extending to the ground into supporting members for the arch, divided into two fluted pilasters with appropriate capitals, decorated in colors and illuminated throughout with 4-cp lamps. The main arch is emphasized in bands of light-red and light-green lamps. The

Fig. 5—Night View of Huntington Avenue.

Fig. 4—Night Effect of Tower Decorations.

Fig. 6—Special Illumination on Huntington Avenue.

whole of this front is also decorated in mosaic and colored lamps.

Passing to the center entrance, a similar decorative scheme was carried out with colored lamps on a smaller scale, presenting a very striking appearance. Fig. 3 shows the center entrance at night as well as the west end of the building.

Fig. 7—Rear of Mechanics' Building, Showing Large Electric Sign.

An analogous scheme was followed on the tower, the general effect of which is shown in Fig. 4. Here the tower decorations, mainly in clear lamps, were enriched by the free use of red, green and amber lamps. In the chief decoration immediately over the entrance space did not permit of a free use of foliage and the mosaic was formed in a fleur-de-lis design, the fleur-de-lis itself being worked out in lamps tinged very faintly blue so as to eliminate the red and to show white against the background. The lamps, save in the mosaics, are spaced at 8-in. intervals on the entire front. In the mosaics the sockets almost touch.

The rear of the building and the West Newton Street end are festooned with Elblight cable, the crossing points of the festoons being marked out with knots of colored lamps. On the rear of the building against the sky line rises a huge electric sign with the words "Electric Show," in all 270 ft. long with letters 18 ft. high. Fig. 7 shows the general nature of this festooning on the rear as viewed from Boylston Street. Although more than 2 miles of cable was used in the festooning, only the smaller portion of the supply available was thus accounted for and the remainder has been used in the interior decorations of the building. So much for the lighting of the building itself.

After much, although considerably hurried, consideration it was decided to carry out the lighting of Huntington Avenue, from Copley Square to Massachusetts Avenue, by means of colored flame-arc lamps, furnishing an entirely novel decorative element in such work. It is obviously impracticable to obtain color in a powerful illuminant without the loss of an enormous percentage of light, and the use of colored globes was therefore out of the question. Even colored flame arcs, unless one desired the ordinary garish yellow, are obtained only at considerable loss of efficiency, but still, far greater brilliancy is available from their use than from using colored globes. A standard arc lamp pole of Gothic design carrying one lamp at the top and three below it on curved arms was designed as shown in Fig. 6, an under-exposed night view from Copley Square. This pole is 30 ft. high to the upper lamp, which is inclosed in an 18-in. opal globe and gives pale-green light. The three lower lamps, fitted with 12-in. globes of opal, furnish pale rose-red light. The lamp cases are dull bronze in finish, with poles painted a verde antique. Through the efficient co-operation of the General Electric Company's arc-lamp department a special short-flame lamp was designed, avoiding the unwieldy length of the flame-arc lamps in ordinary use. For use in these lamps two varieties of special flame electrodes were worked out, pale pink and green respectively, so that the colors are reinforced by simultaneous contrast. The lamps are operated in multiple circuit, controlled by cut-outs in the base of the pole. While they are much lower in candle-power than the uncolored arcs, they are still materially more effective than the arc lamps hitherto in ordinary use, which is of itself a striking comment on the effectiveness of the flame lamps.

At the two ends of the system, Copley Square and Massachusetts Avenue, pairs of pylons 35 ft. high to the topmost lamp mark the entrance. These, like the standard poles, are of Gothic design and carry thirteen flame-arc lamps each, the uppermost and the middle tier being pale green and the others rose pink. Fig. 6 shows also the general appearance of this pylon by night. The effect of the long vista of colored lamps is very striking and is but dimly indicated in Fig. 7, which shows a night view looking east from beyond the Mechanics' Building. The result of this adaptation of the colored-flame lamp is so decorative as to leave little regret that the earlier schemes failed of adoption.

NEW YORK ELECTRIC SHOW.

The New York Electrical Exposition of 1912, to be held at the New Grand Central Palace, Oct. 9-19, will differ from its predecessors in that the historical side of the electrical industry will be emphasized. This is in honor of the completion of thirty years of central-station existence, which is being celebrated this fall by the New York Edison Company. Bearing this in mind, many exhibitors at the exposition and automobile show have arranged their displays to demonstrate the advance either in central-station practice or in the manufacture of electrical goods and apparatus in the last three decades. The exposition itself will be opened with a luncheon to Mr. Thomas A. Edison, given by the New York Edison Company next Wednesday afternoon.

Contrasting especially with these exhibits of old appliances will be the government exhibits presented by arrangement with several departments and the New York Edison Company. Here the latest developments in electrical applications of all kinds will be strikingly presented. Wireless telegraph, for instance, will be the province of the Bureau of Navigation and the electrical school of the Brooklyn Navy Yard. The navy men will set up the very newest type of wireless apparatus, a 20-kw set, with which the first wireless message will be sent to the Panama Canal. The canal itself is to be represented by a large operative model of the Gatun Dam, locks and spillways, provided by the Isthmian Commission. New York State will also furnish an illustration of the use of electricity on the Mohawk River dam at Yosts. This model, too, will be operative.

Less spectacular, but no less important, is the part played by electricity in government accounting. The Bureau of the Census will open a branch at the Electrical Exposition where census cards will be sorted and tabulated by a remarkably complex machine, motor-driven. The Army Signal Corps, the Bureau of Mines, the Department of Agriculture, through several of its bureaus, and the coast-defense division of the army, as well as the National Museum, will join in demonstrating their several electrical activities.

One departure for this year's program is the attention given to the application of electricity to agriculture. That, on a large scale, will be shown by a series of large photographs showing the irrigation systems of the West in connection with government power projects. On a small scale, as one might expect to see it used around New York in the next decade, will be a demonstration greenhouse, show-

ing plants growing as the result of electric radiation and electrified irrigation as it might be developed for truck farming.

The central stations in and around New York City will be well represented. The United Electric Light & Power Company will display model lighting systems for the home, the store and the factory. In the small home-kitchen meals will be prepared entirely by electrical methods. The National Electric Lamp Association has brought together a collection of incandescent lamps to show development from the Goebel lamp of 1870 down to the metallic tungsten lamps of the present time. A novelty will be a series of special automobile lamps.

The New York & Queens Electric Light & Power Company will devote itself to showing the attractions of Queens Borough by means of an automatic stereopticon. The series of views will include home real estate together with sites suitable for factory growth.

The Edison Electric Illuminating Company of Brooklyn has set itself to display the advantages of Brooklyn as a manufacturing center. A panoramic view 100 ft. long will show in colors the water front of that borough. On this map all the commercial and manufacturing developments along the water will be reproduced in miniature, while lighting effects will add to the realism of the picture. The Brooklyn Edison company has been assisted in this work by the Bridge Department of the city of New York and some of the large warehouse and terminal companies.

The Westchester Lighting Company will make its quarters a reception booth for its friends and patrons. This will be decorated with photographs illustrating electrical installations in its territory, which covers New Rochelle, Mount Vernon and other Westchester County cities suburban to New York City.

The New York Edison Company will have a series of exhibits illustrating both its history and growth, together with striking modern applications of its energy. The one surviving old and original Jumbo is to be brought forth from its honored retirement at Shadyside, while a model of the old Pearl Street station of 1882 will be shown. This will contrast with a model of the modern Waterside stations. Modern applications will include an exhibit of the city's aqueduct work being done by electricity; a modern electrically operated print shop, where a small newspaper will be published, together with exhibits of unusual electrical applications, such as painting on chiffon, electrified irrigation and electrical forcing for greenhouse use. The scientific aspects of the company's growth will be demonstrated by a series of charts, while relations with the employees will be shown in an exhibit of educational work and methods that will contain many interesting features.

OLD AND NEW ELECTRIC AUTOMOBILES.

One of the features of the recent "street show" of the Chicago Automobile Trade Association was a parade of old cars. A considerable proportion of the old "electrics" in the parade were furnished by the Woods Motor Vehicle Company. Before the parade the Woods group, including fourteen cars, both old and new, was photographed, and this picture is reproduced herewith. The number under each car indicates the year in which it was built, or of the "model" in the case of the 1913 cars.

Sixteen years' development is represented. The 1896 break, shown in the foreground at the left, was one of the first cars built by the company. It ran under its own power for 12 miles in the parade and at the finish seemed good for as many miles more. When new this car had a maximum speed of 12 miles an hour and would run 25 miles on one battery charge. The 1913 models, shown in the background, are rated by the manufacturer at a maximum speed of 22 miles and a radius of from 80 to 125 miles on one charge.

Near the center of the picture is shown a runabout of 1904. This is said to be the earliest model of a shaft-driven electric vehicle now in operation, and the maker declares that it is the first shaft-driven electric vehicle manufactured and offered for sale in the United States. This machine

Old and New Electric Automobiles.

was the smallest in the entire parade and attracted much attention. Officers of the Chicago association were much pleased by the interest taken in the various parades. A satisfactory stimulus to trade is predicted as a result of the association's work during the automobile "fall opening week."

CONVENTION OF ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS.

(*By Telegraph*)

The opening of the sixth annual convention of the Association of Iron and Steel Electrical Engineers, held at the Pfister Hotel, Milwaukee, Sept. 30 to Oct. 5, also marked the inauguration of a permanent co-operative Safety Congress, a body having broad humanitarian ideals and of industrial scope, whose sessions, attended by many prominent men, were held parallel with those of the electrical engineers' association. At the joint banquet Monday evening Mr. Gano Dunn, past-president of the A. I. E. E., officiated as toastmaster and addresses were made by Dr. J. A. Holmes, director Bureau of Mines; Dr. L. W. Chaney, Department of Commerce and Labor; Mr. R. W. Campbell, attorney Illinois Steel Company; Mr. B. R. Shover, president of the association, and Mayor G. A. Bading, of Milwaukee. A committee on permanent Safety Congress organization, chosen in part from the mining, transportation and manufacturing industries, was also announced by President Shover as follows: Chairman, Dr. L. W. Chaney, Department of Commerce and Labor; Mr. F. W. Houk, Commissioner of Labor, Minnesota; Mr. H. M. Wilson, Bureau of Mines; Mr. B. C. Richards, Chicago Northwestern Railway; Messrs. John Kirby and F. C. Schwedtman, National Manufacturers' Association; Mr. R. J. Young, Illinois Steel Company; Mr. J. T. McCleary, Iron and Steel Institute, and Mr. L. R. Palmer, Jones & Laughlin Steel Company.

The result of the election for officers of the Association of Iron and Steel Electrical Engineers, held at the morning business session, was also made public at the dinner, the following having been chosen unanimously: President, Mr. C. W. Parkhurst, Johnstown, Pa.; vice-presidents, Messrs. E. Friedlander, Braddock, Pa., and O. R. Jones, Youngstown, Ohio; secretary, James Farrington,

LaBelle Iron Works, Steubenville, Ohio. An honorary membership was voted to Mr. Gano Dunn. Mr. C. W. Parkhurst, the newly elected president, is electrical engineer of the Cambria Steel Company, a position he has held for twelve years. He was formerly associated with the old Siemens & Halske Works, Chicago, before its purchase by the General Electric Company. Mr. Parkhurst is a graduate of Lehigh University and a member of the American Institute of Electrical Engineers and the American Electrochemical Society.

The technical program began on Monday afternoon with a paper on mixed-pressure turbines, with special reference to the use of steam regenerators, by Mr. E. D. Dickinson, of the General Electric Company. The paper was discussed by Messrs. Barton Stevenson, Pittsburgh, Pa.; H. M. Gassman, Birmingham, Ala.; W. T. Snyder, McKeesport, Pa.; E. L. Farrar, Pittsburgh, Pa.; O. R. Jones, Youngstown, Ohio; J. H. Wilson, Middletown, Ohio; J. C. Reed, Steelton, Pa.; E. J. Cheney, Schenectady; B. R. Shover, Youngstown, Ohio; T. E. Tynes, Buffalo, N. Y., and A. B. Bartholomew, Donora, Pa. Mr. Wilfred Sykes, of the Westinghouse Electric & Manufacturing Company, followed with a paper entitled "Power Problems in Steel Mills." Messrs. B. G. Beck, Gary, Ind.; R. Tschentscher, South Chicago, Ill.; B. Stevenson, T. E. Tynes, J. Farrington and J. H. Wilson took part in the discussion. A paper on "Blast Furnace Tops," prepared by Mr. A. E. Handy, of the Otis Elevator Company, New York, was read in his absence by Mr. E. C. Smith, Harrisburg, Pa., and was discussed by Messrs. T. E. Tynes, B. W. Gilson, Youngstown, Ohio, and C. Pirtle, Cleveland.

Mr. E. J. Cheney, of the General Electric Company, opened the Tuesday forenoon session with a paper on automatic speed-regulating equipment for induction motors with flywheels. Messrs. T. E. Tynes, C. S. Lankton, Pittsburgh, Pa.; C. E. Bedell, Warwood, W. Va.; B. G. Beck, F. P. Townsend, Ampere, N. J.; W. Sykes, E. Friedlander, Braddock, Pa.; S. Eton, J. Farrington, C. W. Parkhurst and B. R. Shover discussed the subject. A paper on "Direct-Current Motor-Field Coils," by Mr. R. B. Treat, of the Crocker-Wheeler Company, was discussed briefly by Messrs. B. Wiley, Pittsburgh, Pa.; M. A. Whiting, Schenectady; S. Egan, C. W. Parkhurst, C. E. Bedell and T. E. Tynes. A paper by Mr. C. J. Mundo, of the General Electric Company, entitled "Curves and Data for Illumination Calculations" and scheduled for a later program date, closed the morning session. Messrs. B. W. Gilson, Ward Harrison, Cleveland; G. W. Richardson, Philadelphia; J. Farrington, H. M. Gassman, C. W. Parkhurst and B. R. Shover took part in the discussion, paying a tribute to Mr. Mundo's work in improving mill illumination.

Mr. J. F. Lincoln, Lincoln Electric Company, Cleveland, opened Tuesday afternoon's session with a paper on "Arc Welding." In the absence of Mr. Frank Warren, his paper, "Electric Welding Machines," was read by title only and was followed by Mr. M. S. Plumley's paper, "Accomplishments and Possibilities of Oxyacetylene Welding," read by Mr. J. M. Morehead, Chicago. The joint discussion on welding processes was participated in by Messrs. R. F. Patterson, McKee's Rocks, Pa.; E. Friedlander, B. W. Gilson, B. Wiley, J. A. Seed, J. Farrington, T. E. Tynes, W. E. Snyder, C. Pirtle, W. Sykes, R. C. Reed, M. G. Lloyd, Chicago; V. Martindale and George Hills, Garwood, N. J. Mr. Ward Harrison's paper, "The Electric Lamp in the Steel Industry," which had been transferred from Wednesday's program, brought the meeting to a close and was discussed briefly by Messrs. T. E. Tynes, H. M. Gassman, B. Switzer and C. J. Mundo.

On Wednesday the delegates viewed the Vanderbilt Cup automobile race on special cars and in the evening attended a theater party. An elaborate and complete collection of photographs and models of safety devices occupied a display room in the hotel during the joint conventions.

PUBLIC SERVICE COMMISSION NEWS.

NEW YORK COMMISSION, FIRST DISTRICT.

The Public Service Commission for the First District has just issued a fifty-four-page illustrated publication describing the plans for the dual system of rapid transit for New York City. The solution of the rapid-transit problem is discussed and the general construction features of the dual system and the methods of financing are gone into at some length.

NEW YORK COMMISSION, SECOND DISTRICT.

The Metropolitan Telephone & Telegraph Company has complained to the Public Service Commission, Second District, against the New York Telephone Company for refusal of the latter company to furnish telephone service to the complainant. The complainant is located at 135 East Sixteenth Street, New York City, and desires service of the New York company. The commission is asked to make an order directing the New York company to install a switchboard and furnish telephone service promptly. Reports of tests of meters filed with the commission during August, 1912, show that out of 7985 tests 399, or 5 per cent, were fast, 6668, or 83 per cent, were accurate, and 918, or 12 per cent, were slow. Reports were made by 239 companies, but of this number 99 made no tests. There were forty-six companies that did not make any report.

The Public Service Commission, Second District, has begun an investigation into the rates at Buffalo, N. Y., on complaint of the city, the sessions being held in the Buffalo city hall. The interwoven interests of the electrical companies were explained by Mr. Charles R. Huntley, president and general manager of the Buffalo General Electric Company, and an officer and director in other electrical concerns in the vicinity of Buffalo. Mr. Philip H. Barton, of the Niagara Falls Power Company, and Mr. Morris Cohn, Jr., of the Cliff Electrical Distributing Company, also testified. The Cliff Electrical Distributing Company refused to produce its contracts and books relating to the cost of producing electricity, on the ground that it did not sell its product outside of Niagara Falls, and that its business there was confined to manufacturing plants, so that it could not be considered as a public service corporation. The hearings will be continued.

MARYLAND COMMISSION.

The Maryland Public Service Commission last week passed an order which practically meant the winning of the contest of the Telephone Protective Association, an organization composed of Baltimore business men, for a six-month extension of the flat-rate telephone service in the business district of Baltimore. It is reported that the members of the association will proceed at once to gather evidence which they claim will prove that the Chesapeake & Potomac Telephone Company is charging excessive rates. The last order changes a clause in the original order of the commission and extends the flat-rate privileges from Oct. 1, the time set for their withdrawal, until April 1, 1913. At the same time the Telephone Protective Association is to have until Jan. 1, 1913, to submit evidence. The extension was granted on the ground that one commissioner was not present at the original proceedings, held more than a year ago, when there was dissension in the commission on the question of whether the public had been properly represented at the hearings.

A few weeks ago a table of electric rates was presented to the commission by Vice-president Herbert A. Wagner of the Consolidated Gas, Electric Light & Power Company, showing that the Baltimore primary rate of 10 cents per kw-hr. compared favorably with the rates of other large cities of the country. During the hearing last week a statement was made by Mr. Oscar T. Crosby, president of the Wilmington & Philadelphia Traction Company, to the

effect that the tables were absolutely worthless. This statement took counsel for both sides completely by surprise, since Mr. Crosby was testifying for the company. He also gave extensive testimony on the rate of return on an investment in a public utility such as an electric plant, and consumed an entire hour in answering a specific question on this subject.

OHIO COMMISSION.

On Sept. 27 a number of central-station representatives appeared before the commission to discuss the question of wiring buildings for which they are to furnish service and the rules which many of them have formulated and submitted. Mr. L. G. White, electrical expert in the office of the commission, objected to the rule that the company's wires should be brought only to within 18 in. of the building and contended that it would be dangerous to the consumer, since safety devices cannot be attached on the outside. He contended that the wires should be brought within the building. Led by Mr. W. C. Anderson, of Canton, the central-station men argued that the commission's plan increases the danger and works a hardship on the companies. For outside use, it was stated, weatherproof wires are used and they would be highly dangerous if brought inside where rubber-covered wires are used and are demanded by insurance companies. Another trouble encountered relates to labor. Outside and inside wiring are two distinct employments, as the labor men look at it, and there would be trouble if the outside men were required to carry the wires within the buildings, it was said. The commission took the matter under advisement and will render a decision later.

For the first time since its establishment the commission has been called upon to exercise its authority in requiring a public utility to provide suitable service for the public. Recently Mayor McElroy of Ottawa filed a complaint alleging that the Putnam Telephone Company is not furnishing proper service. At a hearing on the complaint Mr. McElroy described conditions as he saw them, while Secretary M. E. Matthews of the company explained the conditions which perhaps stand in the way of first-class service. Two years ago a very severe storm swept Putnam County and the poles and wires of the company were wrecked. Temporary repairs were made and the wires were strung on anything at hand, but it is claimed that the lines have not yet been permanently rebuilt and, as a result, the service is very poor.

SAN FRANCISCO BOARD OF SUPERVISORS.

In a recently enacted ordinance the Board of Supervisors for the city and county of San Francisco, Cal., has fixed the maximum rates for central-station electric service for the year which will terminate June 30, 1913. These rates are given herewith. For electric light and motor service the same schedule applies, as follows:

Minimum bill, per month	$1.00
2 kw-hr. per 16-cp lamp, or less, per kw-hr	.08
2 kw-hr. to 3 kw-hr. per 16-cp lamp	.07
3 kw-hr. to 5 kw-hr. per 16-cp lamp	.06
5 kw-hr. to 9 kw-hr. per 16-cp lamp	.05
Over 9 kw-hr. per 16-cp lamp	.04

In computing the 16-cp lamp equivalent of an arc lamp, two incandescent lamps shall be taken as the equivalent for each ampere of current consumed by the arc lamp.

The maximum rate for arc lamps consuming 7 amp and not less than 70 volts each, or lamps of equal consumption in watts, on a weekly basis, is as next given:

Twenty-four hours per day	$5.00
Sunrise to sunset	3.00
Sunset to sunrise	2.25
Sunset to midnight	1.75
Six nights, sunset to 9.30 p.m.	1.40

Violations of the ordinance are punishable by a fine of $5 or six months' imprisonment, or both.

Current News and Notes

STEINMETZ LECTURE IN CHICAGO.—Once a year Dr. C. P. Steinmetz gives a lecture in Chicago before a joint meeting of the Chicago Section of the American Institute of Electrical Engineers and the Electrical Section of the Western Society of Engineers. This year's meeting will be held as usual at Fullerton Hall, Art Institute, and the date is Oct. 28. The lecturer's subject, as announced, is "Some Problems in Electrical Engineering."

* * *

PROTECTION OF THE RUBBER INDUSTRY.—The Brazilian Bureau of Information, 59 Rue de Richelieu, Paris, France, has translated into English the recently enacted laws and regulations of Brazil for the protection of the rubber industry. The forty-eight-page pamphlet which the bureau is distributing contains a copy of the statute enacted on Jan. 5, 1912, and the decree of April 17, 1912, embodying the regulations in connection with the administration of the law.

* * *

ELECTRICITY IN DENVER PARADE.—The Colorado Electric Club will take charge of illumination of streets and an extensive electrical illuminated parade at the "Mountain and Plains Festival" in Denver Oct. 15, 16 and 17. This is the first revival for years of the Denver carnival. One hundred and fifty club members in costume will man electric floats and ride horses in electric panoplies. Five hundred dollars was voted on Sept. 26 to cover the expenses of costuming.

* * *

OZONE STERILIZATION OF WATER FOR ST. PETERSBURG.—The magistrate and City Council of St. Petersburg have practically agreed to adopt the ozone method in connection with rapid filtration for the cleaning and sterilization of water for the city, on account of the good results obtained from the Siemens & Halske ozone water-works already in operation at Penkowaja. Advertisements for proposals for the plant have already been issued, the city having appropriated 10,000,000 rubles ($7,700,000) for the project.

* * *

COAL WASHING AND COKING.—The Bureau of Mines, Department of the Interior, has recently issued as Bulletin 5 the second edition of the sixty-two-page report on "Washing and Coking Tests of Coal," which covers the work carried out at the fuel-testing plant at Denver from July 1, 1908, to June 30, 1909. These tests form part of the investigation of mineral fuels of this country carried on by the United States Geological Survey under the authority of Congress and were a continuation of the work commenced at St. Louis during the Louisiana Purchase Exposition, 1904. The results are presented in tabular form.

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COAL FIELDS IN COLORADO AND NEW MEXICO.—Bulletin 471-H lately issued by the United States Geological Survey, Department of the Interior, entitled "Coal Fields in Colorado and New Mexico," contains an advance chapter from Bulletin 471, "Contributions to Economic Geology, 1910, Part II." The first portion of this sixteen-page bulletin is devoted to the coal resources of Gunnison Valley, Mesa and Delta Counties, Col. As to future use of these fields, the bulletin states that it is doubtful if their development will ever be extensive. The beds of coal are thin and limited in extent and the coal is also impure. These facts render mining difficult and also interfere with ready combustion. The latter portion of the bulletin is devoted to the Tijeras coal field, Bernalillo County, N. M. It is stated that many attempts have been made to find coal in the Tijeras field in beds thick enough to be worked with profit, but most of these attempts have proved futile. The economic importance of these beds is yet to be demonstrated.

Past Jupiters' Endowment Fund.—The Past Jupiters' Association of the Sons of Jove is composed of nine men who have served as Jupiter, who is the president or chief officer of the order. This association is making provision for an endowment fund for the future development of the order. At the start this fund will be made up of the membership dues of the nine past Jupiters, amounting to $900; a bequest of one past Jupiter, amounting to $1,000, and 2½ per cent of the annual income of the order, estimated at $500. This makes a total of $2,400, in addition to which individual Jovians may voluntarily make such subscriptions as they desire, addressing Mr. J. Robert Crouse, 1818 East Forty-fifth Street, Cleveland, Ohio. No part of either the principal or interest of the fund shall be withdrawn during the first ten years. The Past Jupiters' Association, for this and other purposes, is being organized under a charter from the State of Ohio.

* * *

SOCIETY MEETINGS.

Toronto A. I. E. E.—At the meeting of the Toronto Section of the American Institute of Electrical Engineers on Oct. 4 Mr. Horatio A. Foster was scheduled to deliver an address on "The Principles of Engineering Valuations and Their Applications."

* * *

Philadelphia Section, I. E. S.—The opening meeting of the season for the Philadelphia Section of the Illuminating Engineering Society was held on Sept. 28 at the athletic association grounds of the Philadelphia Electric Company. Prof. Monroe B. Snyder, of the Central High School, read a paper entitled "The Light of the Stars," and Dr. Herbert E. Ives outlined the recent I. E. S. convention at Niagara Falls.

* * *

Electric Club to Visit Sanitary District Hydroelectric Plant.—At the meeting of the Electric Club of Chicago on Sept. 26 an invitation was extended from the Sanitary District to visit the power house and controlling works on the Chicago Drainage Canal at Lockport, Ill., including the use of the steamer *Robert R. McCormick* for the trip. The club has accepted the invitation and the details of the excursion have been left with its entertainment committee.

* * *

Electrical Protective League.—The second annual meeting of the Electrical Protective League was held in Chicago on the evening of Sept. 23, after a dinner at the Hamilton Club. This organization is composed of nearly all the electrical manufacturers, representatives of manufacturers, supply houses and jobbers in Chicago. Its purpose is to protect its members against theft. There was a general discussion of the work of the year, and officers were elected to serve for the ensuing twelve months.

* * *

Institute Banquet in Los Angeles.—About 150 members and guests of the Los Angeles Section of the American Institute of Electrical Engineers took part in a "get-acquainted dinner" which was given in a Los Angeles restaurant on Sept. 24. Chairman George A. Damon, Dr. Henry S. Carhart, Prof. R. W. Sorensen, James E. Macdonald and others made speeches. This, the first social gathering of the kind by the Institute members in Los Angeles and vicinity, was so successful that it is planned to have a regular annual dinner hereafter.

* * *

Meeting of New England Section, E. V. A.—The first fall meeting of the New England Section of the Electric Vehicle Association of America was held at Paul Revere Hall, Mechanics' Building, Boston, on Sept. 30. The following officers were elected prior to a tour of inspection of the Boston 1912 Electric Show: Chairman, Mr. Fred M. Kimball, Lynn, Mass.; secretary and treasurer, Mr. Leavitt L. Edgar, Boston; executive board, Messrs. E. S. Mansfield, Frank N. Phelps, J. A. White, H. L. Converse, Day Baker, F. J. Stone, E. H. Hewins and P. E. Whiting, all of Boston.

* * *

Boston Jovians.—Under the title "Everybody for Everybody Else" the Sons of Jove of New England have issued attractive invitations to their "rejuvenation," to be held at the American House, Boston, Mass., on Oct. 7. The parade, which will form in front of the hotel at 7:30 p. m., will consist of platoon of police, First Corps cadets' band, reigning Jupiter and his congress in automobiles, chairmen of committees, visiting statesmen and invited guests in automobiles, special degree team from New York City in automobiles, candidates for rejuvenation in costume, order of the Rejuvenated Sons of Jove and mounted police.

* * *

Meeting of Commonwealth Edison Company Section, Technical Division, N. E. L. A.—Mr. P. B. Juhnke presided at the meeting of the technical division of the Commonwealth Edison Company Section of the N. E. L. A. in Chicago on Sept. 26. Papers were read by Mr. A. D. Bailey on "Human Engineering" and Mr. D. Macrae on "Storage Battery Engineering." Messrs. R. F. Schuchardt, M. L. Eastman and D. W. Roper took part in the discussion. Members of the N. E. L. A. Orchestra, composed of employees of the company, gave really high-class music. The soloists were as follows: Flute, Mr. M. L. Eastman; clarinet, Mr. T. Becker; violin, Mr. M. P. Botts; violoncello, Mr. D. E. Rowland. The next meeting of the whole section will be held on Oct. 8, when Mr. George M. Reynolds, president of the Continental and Commercial National Bank, will speak on "Money."

* * *

Program of the Railway Signal Association.—The seventeenth annual convention of the Railway Signal Association will be held at Quebec, Can., on Oct. 8-10. The order of events recently announced in the official program is as follows: Tuesday, Oct. 8, president's address, secretary-treasurer's report and reports of the following committees: mechanical interlocking, power interlocking, automatic block, manual block, electric railways and alternating-current signaling, and storage batteries. On Wednesday, Oct. 9, the reports of the following committees will be presented: Signaling practice, standards, and subjects and definitions. On Thursday, Oct. 10, the following committee reports will be submitted: Wires and cables, contracts, and method of recording signal failures. After taking up miscellaneous business and the selection of a place for the next annual convention, the annual election of officers will be held and the convention will come to a close.

* * *

American Mining Congress.—The fifteenth annual session of the American Mining Congress has been called for Nov. 25-28 at Spokane, Wash. In the official call the following topics are announced for consideration: Conservation, workman's compensation, interstate trade commission, mine taxation, federal control of mineral lands, liberal construction of public land laws, water-power, right-of-way over public domain, revision of mineral land laws, the Alaskan situation, railroad construction in Alaska, the use of electricty in mining operations, federal aid for mining schools and mining investments. A special committee having under consideration the use of electricity in metal-mining operations will present a code for the use of electricty in metalliferous mines. The American Mining Congress is a practical organization devoting itself to the economic, administrative and commercial phases of the mining industry. Mr. James F. Callbreath, Denver, Col., is secretary of the organization.

CHICAGO'S LATEST GENERATING STATION.

Commonwealth Edison Company's Northwest Plant, Designed for Ultimate Equipment of 240,000 Kw.

Unit System of Arrangement of Apparatus Adhered to Throughout—Two 20,000-kw Vertical Turbo-Generators at Present Installed—General Description of Main and Auxiliary Steam Equipment—Parking of Station Grounds.

By H. H. Norris.

IN the issue of the *Electrical World* for June 1, 1911, a preliminary account of the new Northwest station of the Commonwealth Edison Company was published. The policy of expansion which led to the planning of this remarkable station was explained and general information as to the layout of the site and the buildings was given. Now that the buildings as planned for the present are complete and all of the machinery installed that is needed for immediate requirements, it is appropriate that a more detailed description of the plant should be given.

The new Northwest station is the third of the modern plants of the Commonwealth Edison Company. The other two are the well-known Fisk Street and Quarry Street stations, located respectively on the north and south banks of the South Branch of the Chicago River, about 2 miles from the intersection of Dearborn and Madison Streets in the downtown business district. The Fisk Street station contains ten 12,000-kw turbine generators, and the Quarry Street station six 14,000-kw sets. The last station is, as the name indicates, located northwest of the business center, being on a 109-acre site on the west bank of the North Branch of the Chicago River, 5½ miles from the down-town section of Chicago. The completed project includes two similar groups of buildings, each to contain six 20,000-kw generating sets arranged on the unit system; that is, with boilers and auxiliaries for each set practically independent. The ultimate cost of the completed project is about $20,000,000, or say $83.50 per kilowatt. This low first cost is due to the size of units employed, namely, steam turbines of practically 30,000 hp each and boilers of 5600 sq. ft. heating surface, ten to each turbine.

The site, on the bank of the North Branch of the Chicago River, within a few thousand feet of the tracks of the Chicago & Northwestern Railway Company, is convenient for the supply of fuel and water and for the disposal of ashes. At the same time it is near the center of a populous and prosperous section of the city and one that is bound to demand a steady increase in electrical energy supply. Being adjacent to a residence district, every effort has been made to produce an attractive park about the station and the

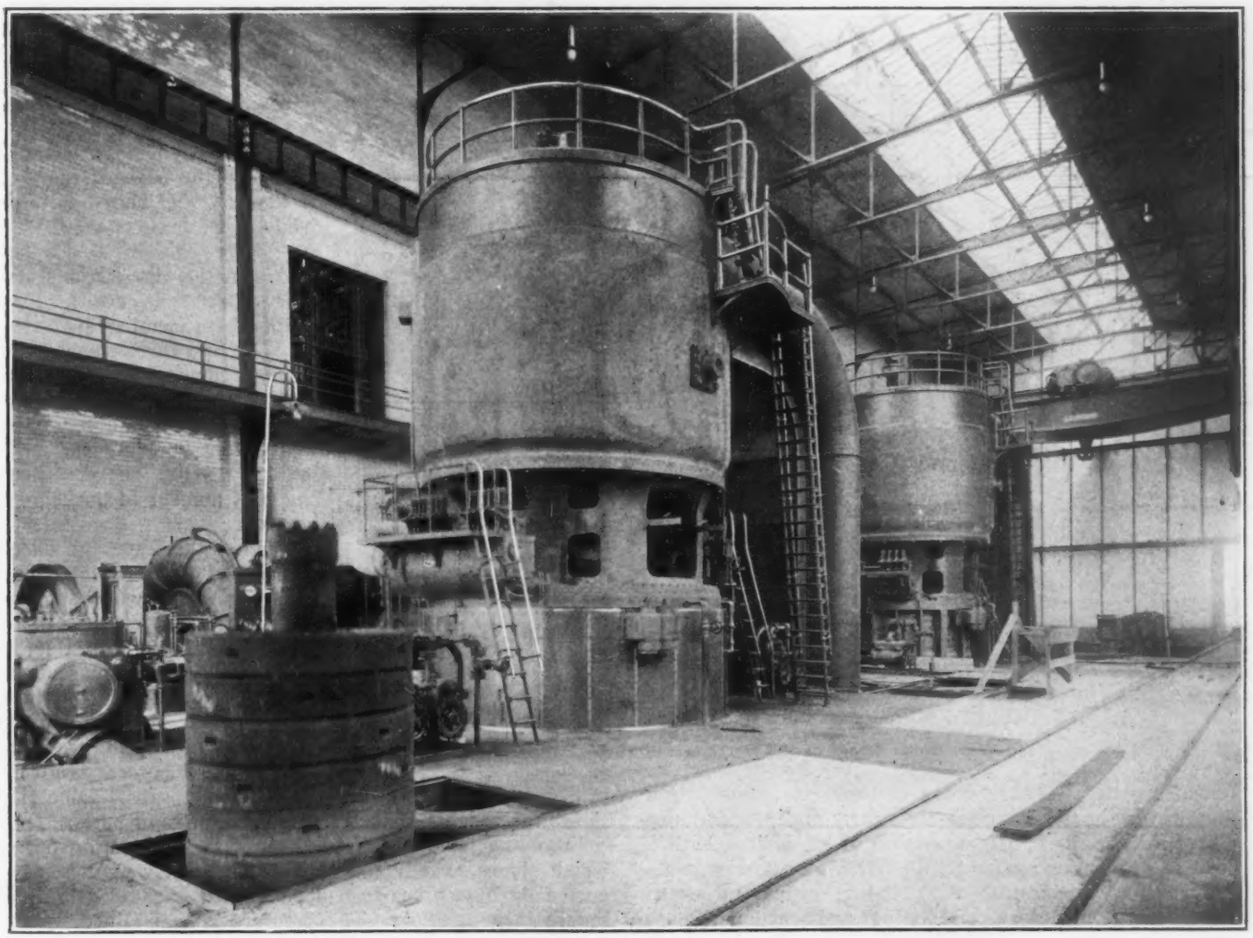

Fig. 1—Generating Room of the Commonwealth Edison Northwest Station.

grounds have been laid out under the direction of a landscape architect. The coal piles and other necessarily unsightly features have been subordinated, from the landscape viewpoint, to trees, flower beds, lawns and winding roadways. The approach from the city side, therefore, gives an impression of beauty and completeness not ordinarily associated with the prosaic generation of electrical energy.

GENERAL LAYOUT OF PLANT

The buildings are placed for the best possible arrangement of fuel and circulating-water supply with due regard to appearance. As this station is being built for the future without hurry, it has been possible to select the site and lay out the buildings and apparatus in accordance with the engineering ideals of the designers. No expense is being spared to get the best possible equipment, using that term in its broad engineering sense.

The buildings will ultimately front on California Avenue, if it is extended through the company's property. They will lie symmetrically about an axis perpendicular to the avenue. This axis is one of the important architectural features of the scheme, for symmetry is an element of beauty in a case like this. On the axis and near the avenue will be a small administration building, and even the coal piles will lie in positions symmetrical with and parallel to the axis. The buildings are of plain design, of structural steel and brick, liberal in proportions but well adapted in size and form to the apparatus which they house.

There are three buildings in each group—the boiler and turbine house, the transformer house and the switch house. The buildings are separated to give security from communication of fire from one to another. The ultimate sizes of these buildings are as follows: Boiler and turbine house, boiler room, 275 ft. by 121 ft.; turbine room, 290 ft. by 70 ft.; transformer house, 290 ft. by 28 ft., and switch house, 290 ft. by 35 ft.

The construction of the plant is readily followed if one remembers that the basis is the unit system. Each half of the twin stations comprises six nearly independent units placed side by side. A unit consists of ten boilers, each of 5600 sq. ft. heating surface, with feed-water heater, pumps and auxiliary apparatus; a 20,000-kw vertical turbo-generator, with condenser, circulating and vacuum pumps, pressure pumps and accumulator for step bearings, etc.; electrical apparatus for transforming, controlling and measuring the output of the generators. In the present boiler house one coal-conveying outfit furnishes two rows of boilers with fuel, but it is probable that in the extension of the station (which now contains but two units) each row of boilers will have its independent coal supply. The excitation system is also not in units, because a common source of excitation for the alternators is considered more reliable and efficient than separate exciters for each unit.

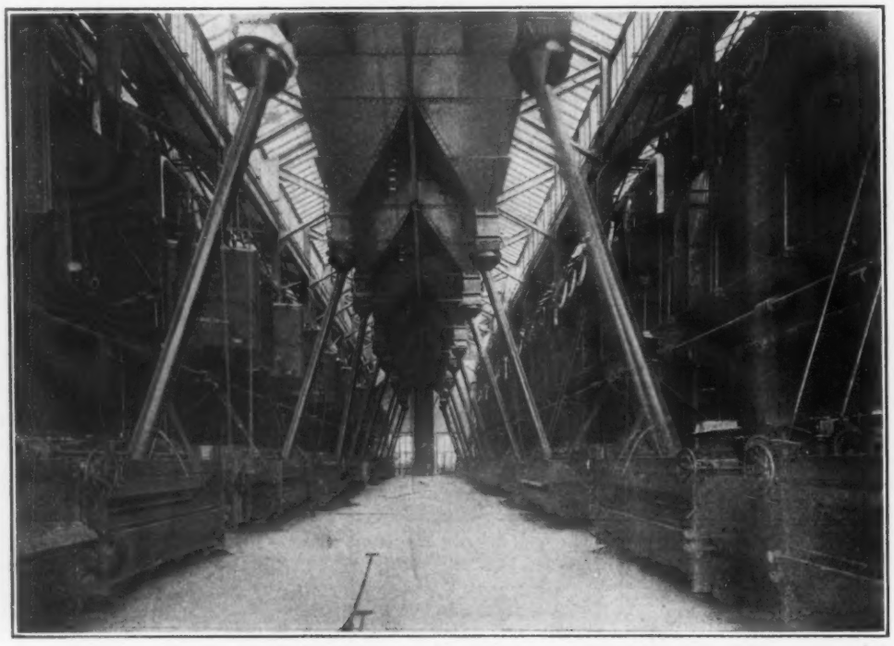

Fig. 2—Boiler Room of the Northwest Station.

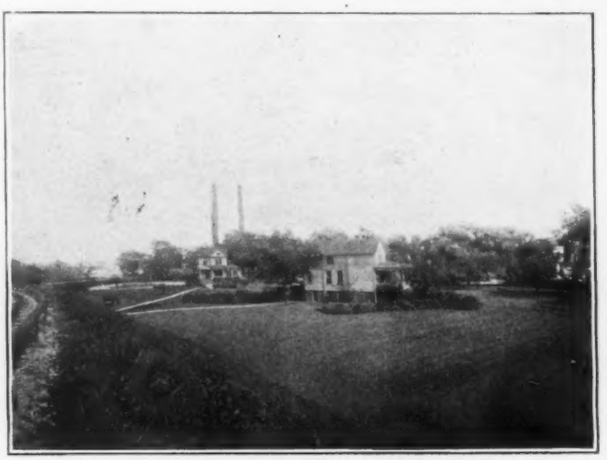

Fig. 3—View of the Grounds and Office Buildings.

TURBINES AND AUXILIARIES.

The turbine room at present contains two 20,000-kw turbines of standard construction, differing mainly in size from those in the station located at Quarry Street. The revolving member contains six disks, each carrying a double row of buckets. The rims of the disks are made up in detachable sections, each of a convenient size for handling and slotted on the inside surface. In assembling they are driven on the edge of the web of the disk and bolted through firmly. The buckets are held at the inside end in a dovetail groove in the rim sections and their outer ends are held in position by a metal strip riveted on. The first three stages have twenty-eight double bucket sections of twenty-four buckets each; the last three have twenty-eight double bucket sections of twenty buckets each. The total number of buckets is, therefore, 7392. The outside diameter of the first-stage wheel is nearly 11 ft. 10 in., and that of the sixth-stage wheel slightly over 13 ft. The lengths of the buckets are given in Table I, on page 703. The guaranteed steam consumption of the turbine at 250 lb. pressure and of the turbine at 250 lb. pressure and 100 deg. superheat is given in Table II, with the corresponding water rate. Table III shows the weights of the turbine and generator parts.

From the table it will be noted that the rotating parts weigh almost exactly 100 tons. This great weight is supported on a step bearing supplied with oil at 800 lb. per square inch pressure. The pressure is maintained by an accumulator and pumps which operate at a pressure of 1200

lb. per square inch, this being throttled at the bearing to the above value. The bore of the accumulator is 8 in. and its plunger stroke is 8 ft. It is designed for 1500 lb. per square inch pressure and is tested to 2000 lb. The cylinder and base are of semi-steel. The plunger is weighted with cast-iron weights 4½ ft. in diameter. The oil for the step bearing is put under pressure by two steam-driven 12-in.

Fig. 4—Coal Conveyor in Monitor Over Boiler Room.

by 3-in. by 18-in. horizontal, double-acting high-pressure oil pumps. The pressure for the upper bearings and the hydraulically operated valve gear is supplied by two 6-in. by 4-in. by 6-in. pumps.

CONDENSER.

The turbine-base condenser, upon which the turbine sits at floor level, contains three sections—the main or center section, with 3750 tubes, and two auxiliary sections with one-half this number of tubes each. The tubes are of brass, 1 in. outside diameter and 17 ft. long. Each has, therefore, 4.44 sq. ft. surface. The total effective condensing surface is 32,000 sq. ft., or 1.2 sq. ft. per b.hp. Under the specifications the condenser must maintain a 2-in. vacuum when condensing 280,000 lb. of steam per hour when supplied with 40,000 gal. of circulating water per minute at 65 deg. Fahr., and 30,000 lb. per hour at 1-in. vacuum with circulating water at 40 deg. In addition, the degree of refrigeration of the water of condensation may not exceed 5 deg. Fahr. over that of vacuum temperature when condensing between limits of 180,000 lb. and 300,000 lb. of exhaust steam per hour.

Of the pumps which are used in connection with the condenser the most conspicuous is the 36-in. volute centrifugal circulating pump, which is driven at 120 r.p.m. by a 20-in. by 30-in. Corliss engine. The pump operates against 20-ft. head and delivers 40,000 gal. of water per minute. The Corliss engine also drives the dry-vacuum pump, the cylinder of which is mounted tandem with the engine cylinder and which displaces 2550 cu. ft. of air per minute. The wet-vacuum pump is a 5-in., two-stage centrifugal machine, turbine-driven, which extracts from the condenser 660 gal. of water per minute.

BOILERS AND AUXILIARIES.

A boiler unit or battery consists of ten boilers, each of a steaming capacity of 33,600 lb. per hour, giving a liberal reserve margin over the steam requirements for the turbines. This reserve takes care of the auxiliaries and allows

TABLE I.—LENGTHS OF BUCKETS.

	STAGE.					
	1.	2.	3.	4.	5.	6.
Length, top, inches	1¼	2	2	2½	5¼	6¾
Length, bottom, inches	2	3¼	3¼	4	9	18

for regular cleaning of the boilers even if the turbines are fully loaded. Each boiler contains fourteen rows of 4-in. tubes, sixteen tubes to the row, the entire heating surface being 5600 sq. ft. There is also a single-loop superheater designed for 125 deg. superheat at full steaming capacity. The chain grate is 10 ft. wide by 11½ ft. long, having an effective area of 115 sq. ft. This type of grate is very successful in burning the screenings used about Chicago for power purposes. These screenings contain about 10,000 heat units per lb. Below the grate are two hoppers, the front one for the fine coal which drops, unburned, through the front end of the grate. The other is for the ashes and is located at the back end of the grate under the middle of the boiler.

TABLE II.—GUARANTEED STEAM CONSUMPTION.

Load in Kw.	Lb. Water per Kw-hr.	Lb. Water per Hp-hr.
10,000	14.00	10.4
15,500	13.45	10.0
20,000	14.00	10.4

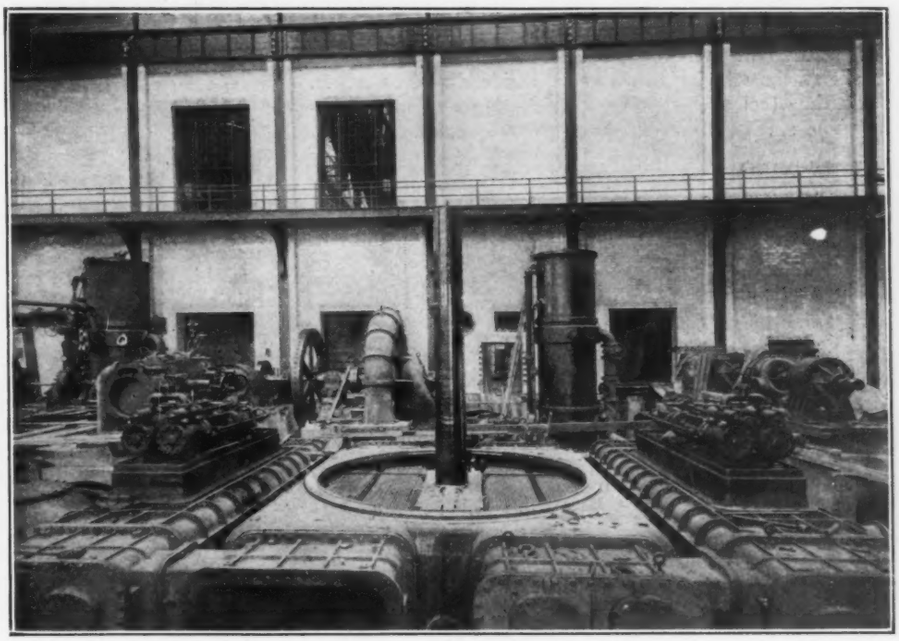

Fig. 5—Condensers Under Base of Vertical Curtis Turbine.

The steam is collected from each battery of boilers in a 16-in. header, located in a header room below the rear ends of the boilers. This header is supported on roller bearings resting on the floor, and it is fixed at the turbine-room end,

where a hydraulically operated valve is located. The boiler leads are of 6-in. pipe. The tops of the boilers are conveniently arranged for inspection and repair of the various valves, a continuous runway being provided from end to end of the row. The safety valves discharge into vertical open pipes ending above the roof, thus providing against the discharge of steam into the boiler room and eliminating

TABLE III.—WEIGHTS OF TURBINE AND GENERATOR PARTS.

Steam End:	
Main condenser shell, lb	141,000
Wheel case and diaphragms, lb	166,000
Wheels, lb	71,400
Turbine shaft and coupling, lb	22,600
	401,000
Generator End:	
Armature stool, lb	56,000
Armature, lb	255,000
Field, lb	105,000
Top shield, lb	44,000
	460,000
Total	861,000

danger from scalding. An 8-in. auxiliary header connects the boiler units and makes it possible to use steam from one unit to supplement the supply from another.

Each row of boilers is supplied with feed water by means of two 5-in., three-stage centrifugal pumps driven by steam turbines at 2300 r.p.m. and designed to deliver 700 gal. per minute against 285 lb. per square inch pressure. The feed water is drawn from the heater and hot well at a temperature of 210 deg. Fahr. This heater is of the closed type and contains 4000 sq. ft. of heating surface. It can raise the temperature of the 320,000 lb. of water per hour from 70 deg., at which it comes from the condenser, to the above value, when supplied with steam at 2 lb. per square inch pressure. The steam for this purpose comes from the several auxiliary engines and pumps. The make-up water is introduced by suction into the feed-water heater, the water level in the hot well being automatically controlled by a float-operated valve.

CHIMNEYS.

One stack will care for the waste gases of ten boilers. The six stacks will be alike, 17 ft. inside diameter, 18 ft. outside the steel shell, giving a brick thickness of nearly 6 in. The stacks, of which three are now built, stand 250

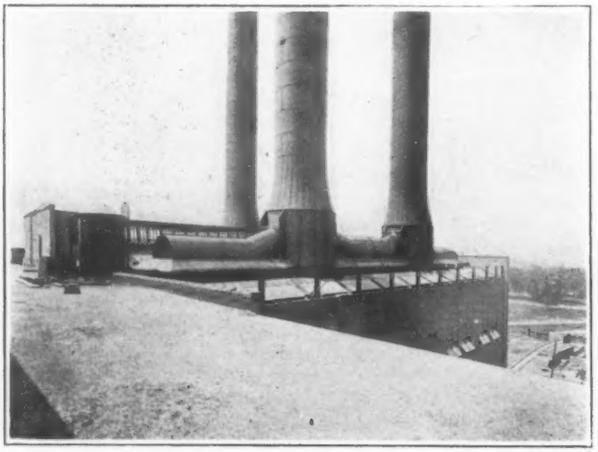

Fig. 6—Smokestacks with Steel Bracings.

ft. high above the boiler-room floor and 210 ft. above the roof. They are built up of twenty-two rings of plates, the thickness of which varies from ½ in. at the bottom to ¼ in. at the top. The total weight of plates in one stack is 133 tons. The stack is supported upon a braced steel structure resting upon its own concrete footings and so tied in with the main building frame as to make a rigid support for the stack. When one contemplates the enormous weight of the stack, the forces which may act upon it in a gale and the distance (nearly 70 ft.) from the bottom of the bell to the footings, he realizes what careful designing is necessary to render the structure safe.

The smoke flues rest on the roof trusses and are, therefore, out of doors. The space above and behind the boilers is thus kept clear for the accommodation of piping.

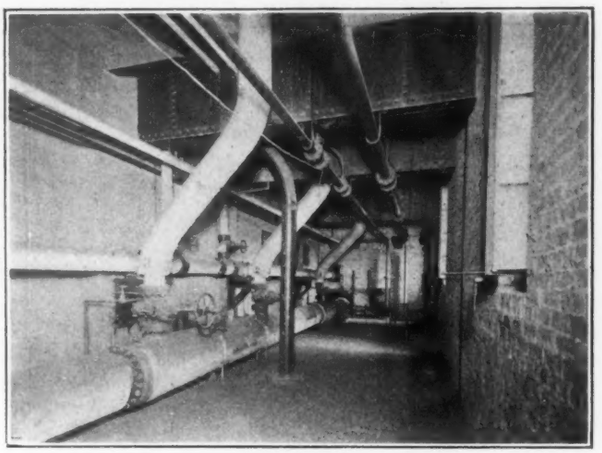

Fig. 7—Header and Hydraulic Valves.

FUEL SUPPLY.

The principal supply of fuel will be received over the Chicago & Northwestern Railroad, which runs less than a mile from the power plant. On a private right-of-way a third-rail electric road of electrified-steam-road standard construction has been erected. At the railroad end a large terminal yard will eventually be built so that the company can store several hundred coal cars. The steam road would not permit electrification of any of its own tracks, so that at present the electric locomotives of the Edison company take the cars from the railroad at the boundary of the property of the latter and either store them on the Edison company's main track or haul them to the sidings at the power plant.

In the large space which will eventually lie between the twin stations is the yard coal storage, ample for 250,000 tons. Over the piles bridge cranes will eventually be installed and the yard trackage so arranged that cars can be unloaded and reloaded with minimum expense by electrically operated clamshell buckets. Under the firing floor between two rows of boilers is a long room, 37 ft. wide and 27 ft. high, in the floor of which are the concrete coal receiving hoppers, nine in number. Below these is a tunnel about 16 ft. wide and 20 ft. high, with a track for the portable coal crushers. On the floor of the tunnel is the bucket conveyor, which takes the coal from the crushers. The conveyor belts the boiler house, its upper section being carried in a monitor on the roof about 104 ft. above the floor of the tunnel. The nine receiving hoppers have a capacity of about 1480 tons, or say 74 tons per boiler served by them.

The coal crushers, of which there is one for each two rows of boilers, are four-roll crushers, having two Cornish and two fluted rolls. Each crusher is driven by a 70-hp, three-phase, 60-cycle motor, and it has also a traversing motor of 7½ hp. The specifications require that 95 per cent of the crushed product must pass a ¾-in. clear opening. The buckets of the conveyor are 34 in. by 36 in. and the speed is 45 ft. per minute. The conveyor is driven by a 35-hp, three-phase motor which is located at the roof level. The motor drives, through a reducing gear, a large spur wheel, and it is about fully loaded when the conveyor is operating at its full capacity of 175 tons per hour. A ratchet arrangement has been put on the spur wheel recently to prevent accident in case of trouble with the motor

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The conveyor gallery for a pair of boiler units is located over the boiler-room coal bunkers, which consist of a single row of bifurcated hoppers, one for each opposite pair of boilers. Each hopper holds 126 tons of coal, so that the total storage capacity in the building is 137 tons per boiler, sufficient for somewhat more than a day's requirements under the heaviest operating conditions.

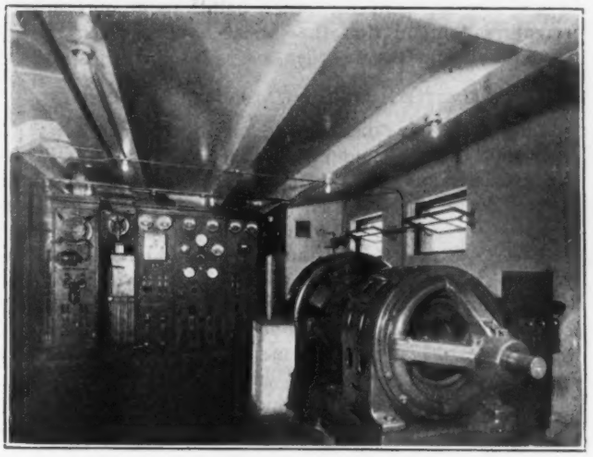


Fig. 8—Exciter Bay.

The coal-receiving room on the ground floor is equipped for either dump cars or for ordinary coal cars. The former can dump their load directly into the receiving hoppers. Ordinary cars are unloaded by means of a clamshell bucket crane. The bucket has 2 cu. yd. capacity and it can handle 80 tons of slack or 60 tons of run-of-mine per hour. Its span is 34⅓ ft. from center to center of runway rails, and the maximum lift of bucket is 15 ft. Four three-phase, 60-cycle, 220-volt motors are required for the crane as follows: 37 hp on main hoist, 37 hp on auxiliary hoist, 5 hp on the trolley travel and 11 hp on the crane travel. The fine coal hoppers under the boilers, already referred to, empty at the sides of the coal-receiving room into the receiving hoppers, and the fine coal thus finds its way through the crusher and the conveyor to the bunkers again.

DISPOSAL OF ASHES.

On the ground level and on each side of the coal-receiving room is a space to accommodate the ash cars. A track is located directly under the spouts of the hoppers, connecting with the electric railway system already referred to. The ashes are at present used for filling up land to be used later for track space. Each hopper has capacity for a day's accumulation of ashes.

WATER SUPPLY.

Water for condensing purposes is required at such a rate, and continuity of supply is so vital, that unusual precautions have been taken to insure ample and continuous supply. Concrete intake and discharge tunnels, 10 ft. by 10 ft., run from the turbine room to the Chicago River, somewhat over 600 ft. away. For most of the way one is directly over the other and the top is a few feet below the ground level. The walls of the conduit are 2 ft. thick, and the roof, floor and dividing horizontal partition average about the same. The injection tunnel is underneath the discharge and draws water from the river 450 ft. upstream from the outlet of the discharge tunnel. The mouth of the injection tunnel is covered with a novel revolving screen which automatically cleans itself of accumulations of debris removed from the water. The screen is 5 ft. wide and is made up of sections covered with woven wire each 16 in. long. This belt of sections passes over an electrically driven drum at the top and over an idler drum at the bottom, being inclined at an angle of about 30 deg. from the vertical.

APPLICATION OF HYDROELECTRIC ENERGY TO IRRIGATION PUMPING IN SOUTHERN IDAHO.

Description of Various Installations, with Data on Water Requirements and Considerations Governing Rates for Service.

By E. A. Wilcox.

THE growth of the pumping business has been so rapid in certain localities that very little is known by the general public of the actual development that has taken place or of the immense future that the application of electrically driven pumps to the field of irrigation has made possible.

In California, Oregon, Washington, Colorado and a few other Western States electrically operated pumping plants have been in use for irrigating the land for a considerable length of time. In some of these States water is pumped from wells where an underground supply is found to exist. In other States the plants are located along small streams, rivers and lakes and are used for lifting water to the adjoining land.

Four years ago practically nothing was known of irrigation pumping in Idaho. The only plants then in operation consisted of small low-lift stations owned by individuals, the first one of which was installed by General L. V. Patch, of Payette. The water was lifted 70 ft. and was used to water his 160-acre ranch. The success of this initial installation, coupled with the consistent boosting of this and other pumping projects by General Patch and his associates, has done much to bring about the wonderful results that have been accomplished thus far. The results may be gaged by the fact that to-day a greater acreage of land is watered by electrically operated pumping plants in the State of Idaho than in any other State of the Union, or possibly in any other part of the world. Approximately 125,000 acres of land are under pumping systems already installed, and at least 150,000 acres additional will be watered in a similar manner in a short period of time.

The general development of the State of Idaho has been more rapid than that of any other State. One instance of this growth is the town of Twin Falls. Where seven years ago there was merely an uninhabited sagebrush desert to-day is found a city of 7500 people, modern in every particular, and surrounded by a half million acres of well-cultivated land. This rapid growth has been due mainly

Fig. 1—Typical Small Pumping Plant at Twin Falls.

to the development of irrigation enterprises within the State.

The earlier installations were of the gravity type, the water being diverted from the streams and distributed over wide territories. The easiest and cheapest developments were the first to be carried to completion. As the country advanced and the demand for irrigated land increased, the more expensive projects were undertaken, and the ones

SIDE GUIDE AND GRIP

that have lately been put under way are found to require one or more expensive reservoirs, diverting dams, long earth or rock cuts, tunnels and often many miles of side-hill canals or flumes in order to deliver water upon the land. The cost of installing, maintaining and operating these various necessary adjuncts to the modern gravity project is often very considerable.

When it became generally known that the modern electrically operated pumping plant was proving successful on small tracts of land the local engineers estimated that the larger propositions might be equally or even more feasible than the smaller ones. It was soon shown that the pumping plant was far cheaper in construction and often more reliable and satisfactory than the average gravity system. The greater number of pumping projects in Idaho are located along the course of the Snake River and the plants are built on the banks of this great stream. On account of these natural conditions the pump houses are comparatively inexpensive to construct: very short pipe lines are necessary, and the water is delivered directly to the land, making it unnecessary to construct any expensive diversion works or long lines of main canals.

As some of the finest and most fertile land in southern Idaho is so situated that it can be more feasibly watered under a pumping system than by the more familiar gravity methods, a decided impetus has been given to the pumping business during the past two or three years.

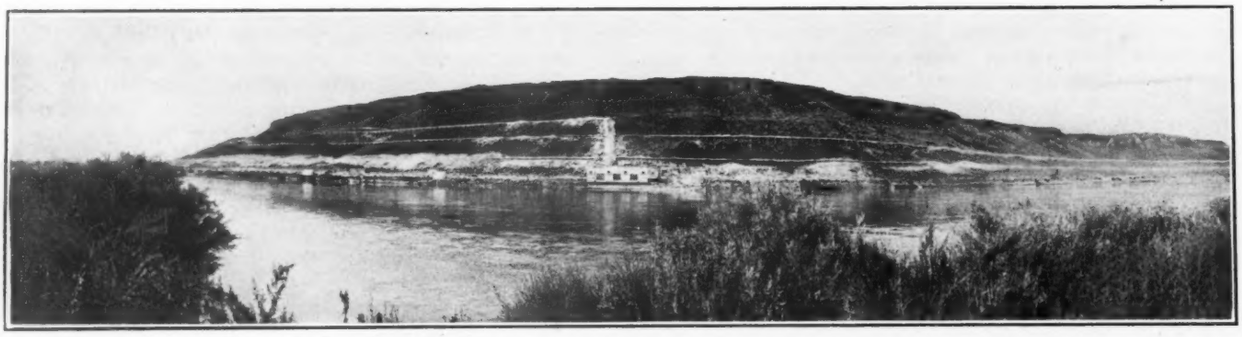


Fig. 2—Snake River Irrigation Company's Pumping Plant.

It has been found that it is much cheaper and better to water a large tract of land with one large pumping plant than with a number of smaller plants. The machinery efficiency is greater, the losses through seepage and evaporation are reduced, and the cost of installing is lowered by the use of a large pumping plant.

WATER REQUIRED FOR IRRIGATION.

A large part of the land under irrigation projects in Idaho is segregated under the Carey law, by the provisions of which private companies dispose of land and water rights to settlers at regular drawings under contract with the State. The State contract specifies the manner of development, the amount of water right and the price per acre for which the land and water right is to be sold. Many local conditions affect the water supply that it is necessary to provide under any irrigation proposition. The altitude of the land being watered under Idaho irrigation projects varies from 2200 ft. to as high as 5500 ft., with the result that whereas water is required for irrigation for only four months in the higher altitudes it may be required for six months in the lower districts, where the irrigating seasons are longer. On account of the abundant stream flow available for most of the irrigated land in Idaho the farmers have become more or less wasteful of the water, many of them using several times the quantity that would best mature their crops.

Many different kinds of soils are found in Idaho and they absorb water in varying amounts. The land in the lower altitudes is found to require more water than that higher up, owing to the warmer atmosphere and the consequent rapid evaporation. The kind of crop that is raised on a certain piece of land has a large bearing on the quantity of water that must be made available. Hay crops require more water than grain, grain crops more than potatoes, and potatoes more than fruit trees. Some experienced fruit growers have matured orchards on the lower lands where the maximum supply of water never exceeded 6 in. in six months. On the other hand, some inexperienced irrigators contend that they must have at least 7 ft. of water in six months in order to grow their crops properly.

RELATIVE MONTHLY WATER REQUIREMENTS.

Many tests have been made on the older gravity projects to show the amount of water that is actually used during each month of the irrigating season. Table I was taken from a report of the operating irrigation engineers of Idaho for November, 1911. The data were compiled by Mr. W. G. Steward, assistant engineer on the Boise Project.

The Boise Project, on which the above data were secured, is an old tract having an abundant supply of water and cultivated by farmers who are accustomed to using as much water as they wish.

Various tests made on all kinds of growing crops have shown, however, that the very best results are secured by using less water than the average farmer claims to be necessary. In no case has it been found wise or profitable to use more than 0.5 in. of water, and rarely is this amount required.

TABLE I.—WATER REQUIREMENTS.

Period.	Bench Land, 105,258 Acres.		Bottom Land, 26,359 Acres		Nineteen Canals, 131,617 Acres.	
	Acre Feet per Acre.	Per Cent Total Diverted.	Acre Feet per Acre.	Per Cent Total Diverted.	Acre Feet per Acre.	Per Cent Total Diverted.
April 1 to 15	0.05	1.3	0.12	2.9	0.06	1.5
April 16 to 30	0.26	6.8	0.20	5.1	0.26	6.4
May 1 to 15	0.38	9.2	0.33	8.2	0.37	9.1
May 16 to 31	0.42	10.1	0.36	8.9	0.40	9.9
June	0.88	21.6	0.41	20.3	0.87	21.3
July	0.88	21.4	0.77	19.3	0.86	21.0
August	0.52	12.5	0.64	16.0	0.54	13.2
September	0.48	11.3	0.54	13.5	0.48	11.9
October	0.23	5.8	0.23	5.8	0.23	5.7
Total	4.10	100.0	4.00	100.0	4.07	100.0

The relative quantities of water usually necessary for irrigation during the different months of the irrigation season are shown in Table II. The data were compiled by Mr. Don Bark, government expert in charge of irrigation

investigations in Idaho. They show the results of Mr. Bark's tests, made during 1910 and 1911 on 123 fields of hay and grain planted in medium lava ash and clay soils and in porous gravelly soils. The experiments were made at various points between St. Anthony, Idaho, and Weiser, Idaho.

TABLE II.—RELATIVE MONTHLY WATER REQUIREMENTS.

Months.	Percentage of Total Applied Each Month During 1910 and 1911.				Equivalent Percentage of Maximum Demand.
	Lava Ash and Clay Soils.	Porous and Gravelly Soils.	Average of Both Kinds of Soil.	Approximate Average Both Kinds of Soil.	
April.....	1.20	3.28	2.24	2.50	8.33
May.....	17.33	13.60	15.46	15.00	50.00
June.....	29.70	30.57	30.14	30.00	100.00
July.....	30.65	26.43	28.54	30.00	100.00
August.....	17.44	25.02	21.23	20.00	66.66
September.....	3.67	1.10	2.39	2.50	8.33
	100.00	100.00	100.00	100.00	

The pertinent result of these tests is given in the last column of the tabulation. It indicates that 8⅓ per cent of the maximum demand for water will come in April, 50 per cent in May, 100 per cent in June, 100 per cent in July, 66⅔ per cent in August, and 8⅓ per cent in September.

SOURCE OF ELECTRICAL ENERGY.

Some of the finest water-power sites to be found in the world are on the Snake River, in Idaho, in the immediate neighborhood of many attractive pumping projects. Among these sites are Twin Falls, Shoshone Falls, Thousand Springs, Upper Salmon Falls, Lower Salmon Falls, Malade Falls and numerous others. All of these water-power sites are absolutely free from ice trouble and are natural-head developments that are being constructed independently of impounding dams or reservoirs. At least 150,000 hp can be developed at the sites mentioned above. On account of the ease and cheapness with which power may be developed and the short distance the energy must be transmitted, it has been possible to make very low rates for electric pumping.

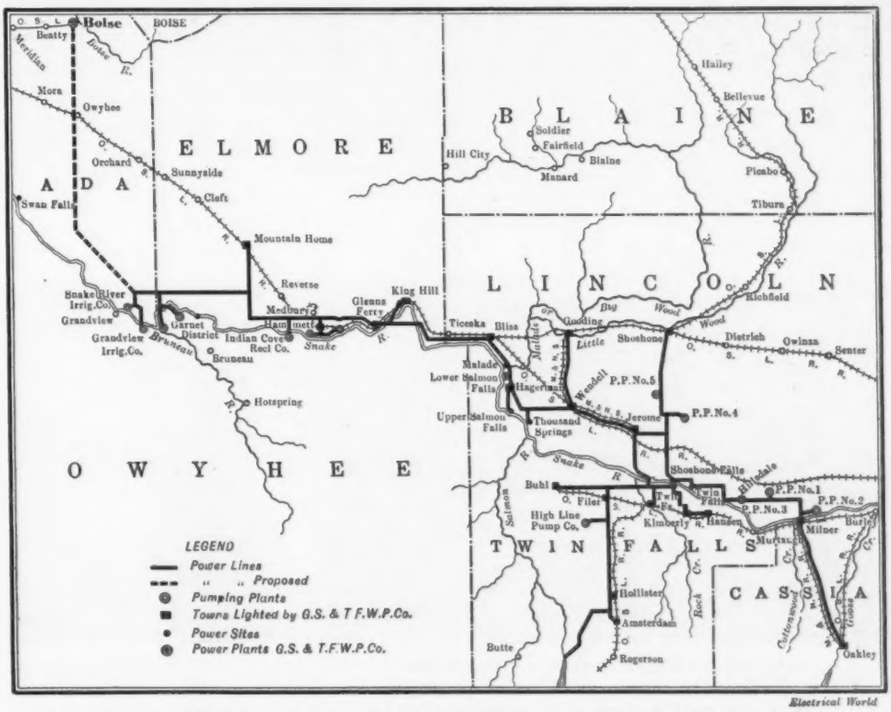
The development of southern Idaho irrigation pumping enterprises has been carried on largely through the agency of the Idaho-Oregon Light & Power Company, Boise, Idaho; the Government Reclamation Service, Boise, Idaho, and the Great Shoshone & Twin Falls Water Power Company, Twin Falls, Idaho. The last-named company, although the latest to enter the field, has up to the present time done more than any other toward developing the irrigation pumping business.

MINIDOKA PUMPING PROJECT.

The largest individual pumping project in the world was completed three years ago by the Government Reclamation Service near Minidoka, Idaho. There are 15,000 acres under a 31-ft. lift, 16,000 acres under a 62-ft. lift and 24,000 acres under a 93-ft. lift. The pump houses are several miles apart. At the No. 1 plant water for the entire acreage is raised from the main gravity canal to the first-lift canal. The No. 2 plant elevates the water for the two upper canals from the first-lift canal. The No. 3 plant raises the water from the second-lift canal to the high-lift canal. The buildings are of reinforced-concrete construction. The machinery consists of large vertical type Allis-Chalmers centrifugal pumping equipment directly connected to Westinghouse phase-wound motors. The entire equipment rating of the three plants is approximately 3000 hp. The energy for operating the pumps is furnished from the government power house located at the diversion dam in the Snake River near Minidoka, Idaho. This installation was described in the *Electrical World*, Dec. 30, 1911.

HIGH-LINE PUMPING PROJECT.

The land under this project consists of 3800 acres a few miles southwest of Twin Falls. The lifts are 42 ft. and 84 ft., although the greater portion of land is under the lower lift. The water is diverted from the high-line gravity canal of the Twin Falls Land & Water Company. The building is of heavy lava rock construction. The machinery consists of a number of General Electric motors having a total rating of 500 hp directly connected to horizontal-type American Well Works double-suction, split-case, centrifugal pumping equipment. The energy for operating the plant is furnished from the lines of the Great Shoshone & Twin Falls Water Power Company. This project has been in constant and successful operation for two full irrigating seasons.



Electrical World

Fig. 3—Map of Transmission System of Great Shoshone and Twin Falls Power Company.

TWIN FALLS NORTH SIDE PUMPING PROJECT.

This project comprises 14,000 acres of choice land on the north side of the Snake River between Jerome and Milner, Idaho. It is a Carey act project and is composed of several large bodies of high land adjoining the gravity canals

of the Twin Falls North Side Land & Water Company. There are five separate pumping plants installed, and the water is lifted from the gravity canals in heights varying from 35 ft. to 60 ft. The buildings are well-designed brick and concrete structures and the equipment consists of large Westinghouse motors directly connected to R. D. Wood horizontal-type, centrifugal, split-case, double-suction pumps. The total motor rating of the five pumping plants is 2500 hp, each plant having at least one reserve pump and motor outfit. The energy for operating the motor equipment is supplied by the Great Shoshone & Twin Falls Water Power Company. No trouble has been experienced in operating the plants and the results of one year's service have been very satisfactory.

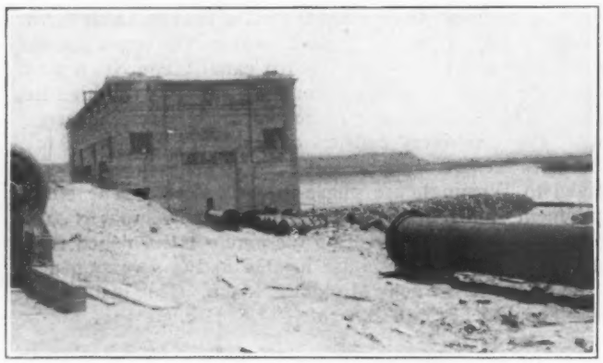


Fig. 4—Snake River Irrigation Company's Pumping Plant.

INDIAN COVE PUMPING PROJECT.

The Indian Cove tract is located in the Snake River Canyon about 20 miles southeast of Mountain Home, Idaho. It comprises about 10,000 acres of choice fruit land. A pumping plant has been installed to irrigate 3500 acres under the 100-ft. lift, and the surveys and plans have been completed for covering the rest of the tract by lifting the water 250 ft. from the Snake River. The enterprise was promoted by Captain O. M. Carter and has been in operation for practically two seasons. On account of the land being held in private ownership, the project was handled in a different manner from that characterizing a majority of the Idaho pumping propositions. A construction company (the Indian Cove Reclamation Company) installed the pumping plant and irrigation system. After the completion of the works an operating company (the Indian Cove Canal Company), composed of entrymen and settlers under the project, took over the system, giving in exchange individual water contracts. An irrigation district has since been formed by the settlers, under the plan of which irrigation district bonds will be issued and exchanged for the water contracts. The pump house installed by the construction company is an exceedingly neat and attractive reinforced-concrete building. The machinery consists of four large Westinghouse phase-wound motors, having a total rating of 600 hp, directly connected to horizontal-type, single-suction Krough centrifugal pumps. Energy for operating the Indian Cove plant is supplied from the lines of the Great Shoshone & Twin Falls Water Power Company.

Fig. 5—Pumping Plant No. 2, Twin Falls.

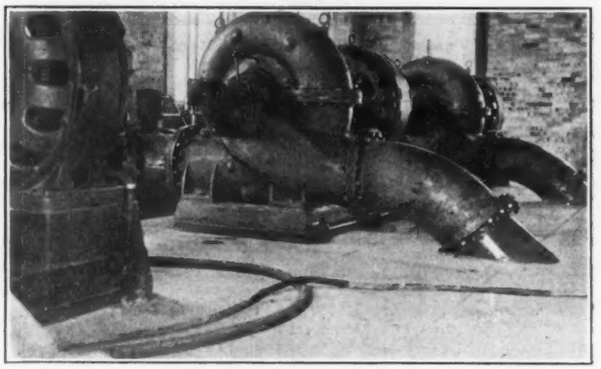


Fig. 6—Interior of Pumping Plant No. 2, Twin Falls.

SNAKE RIVER PUMPING PROJECT.

This pumping project, located about 20 miles southwest of Mountain Home, Idaho, in the Snake River Canyon, comprises approximately 15,000 acres of choice fruit land. The water is elevated from the Snake River through three direct lifts of 40 ft., 85 ft. and 146 ft. The pump house is a massive reinforced-concrete building. The machinery equipment consists of five 450-hp Westinghouse motors directly connected to Worthington horizontal-type, split-case, double-suction pumps. Energy is obtained from the Great Shoshone & Twin Falls Water Power Company, and the plant has operated successfully for one full season.

OTHER PUMPING PROJECTS.

In addition to the pumping projects described in more or less detail herein, there are a number of other interesting pumping developments in southern Idaho. The Payette Heights Project covers 3800 acres, with a direct lift of 146 ft. The Payette-Oregon Slope Project covers 7000 acres, with two lifts of 40 ft. and 100 ft. The Ontario-Nyssa Project covers 7500 acres, with a direct lift of 70 ft. The Kingman Colony Project covers 2500 acres, with several lifts varying from 30 ft. to 70 ft. The Gem Irrigation Project, now in course of construction, will cover 34,000 acres, with lifts varying in height from 35 ft. to 160 ft. The Grand View Irrigation Project, in course of construction, will cover 4000 acres, with lifts of 30 ft. and 70 ft. There are also a large number of smaller pumping plants installed all along the Snake River, varying in rating from 1 hp to 100 hp. The rapidity with which the pumping plants have been installed and the excellent machinery and

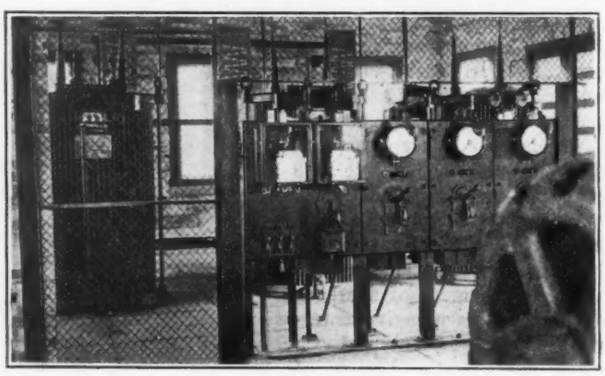


Fig. 7—Interior of Pumping Plant No. 2, Twin Falls.

construction that have been used are remarkable features of the development.

RATES FOR PUMPING.

In evolving a system of charging for electric energy several important considerations had to be taken into account. It was necessary to make a rate so low that the average farmer could afford to pay his proportionate share

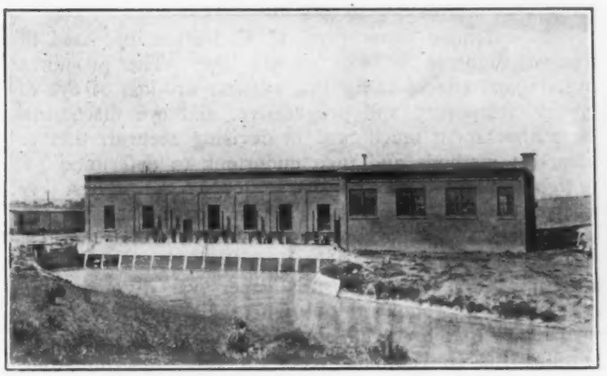


Fig. 8—Minidoka Pumping Plant.

of the charge, rendering it possible for him to compete with his neighbor on the gravity project, thereby insuring the success of the pumping business as a whole. As most of the pumping is done in a large way on tracts of 1000 acres or more, where it is necessary to keep water in the ditches continuously and where all the plants require energy simultaneously, it is impossible to figure on a diversity factor other than unity. It is also found from the last column of Table II that the load-factor for a season of six months is approximately 55.55 per cent on the basis of the experiments made by Mr. Bark.

With these considerations in mind, the outcome has been that in installations of 250 hp and more the usual rate is based on the highest half-hour peak recorded by a graphic meter during the irrigating season. While this method is somewhat unsatisfactory on account of the inaccuracies of the recording meters at present manufactured and the further difficulty usually encountered in explaining to the land owners the reason for making the rate on such a basis, nevertheless it has been quite generally adopted. The usual price charged is $20 per hp for a six-month season, the power being noted on the secondary side of the transformers furnished by the consumer. As it was

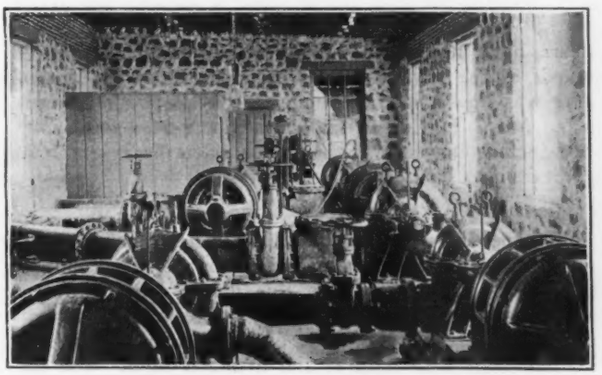


Fig. 9—Interior High-Line Pumping Plant.

shown before that the approximate load-factor is 55.55 per cent, it would be necessary to charge a rate of at least $36 per hp in order to secure a revenue of $20 per hp if the charge were based on a watt-hour meter reading.

It has been found by actual experience that the peak-load method of charging has a great advantage in that it encourages the farmer to do more irrigating in the early and late season and to economize in the use of water during June and July, thereby reducing his peak requirements. In this connection it might be mentioned that it is possible to effect a great saving of water (sometimes as high as 75 per cent) by means of thorough cultivation of the soil.

CONTRACT.

An energy contract is made with the irrigation com-

Fig. 10—Indian Cove Pumping Plant.

panies at the time the plants are installed. The contract binds the electric company to deliver energy perpetually, but the irrigation company may terminate the contract by giving written notice of its intention so to do six months prior to the termination of any ten-year period. The making of contracts in perpetuity is necessary in order that entrymen may fulfil the requirements of the law in making proof on desert, homestead and Carey act entries.

ELECTRIC HEATING.

On account of the peculiar conditions that exist in southern Idaho, fuel being more or less expensive, it has been found profitable to dispose of the surplus energy not required for pumping in the winter for general heating purposes during that season. As a result there are hundreds of homes, offices and places of business in the Twin Falls country that depend entirely upon electricity for their supply of heat. This business is handled by the central station on a flat-rate basis, varying with the size of installation and the number of months the energy is used.

COST OF PUMPING.

The energy required for pumping is directly proportional to the lift and to the quantity of water lifted. On account

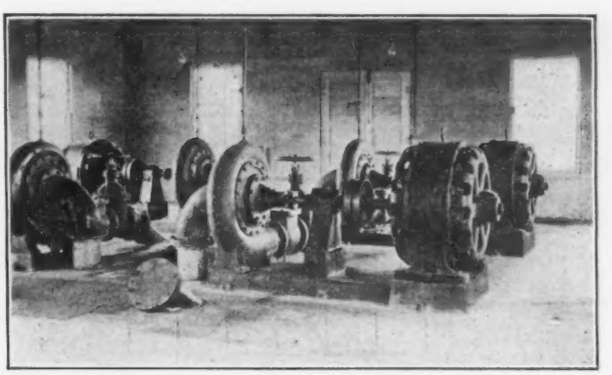


Fig. 11—Interior of Indian Cove Pumping Plant.

of the short space of time the several pumping plants have been in operation, very few reliable data regarding the actual cost of pumping have been obtained thus far. In the absence of such data the accompanying curves were prepared to show the cost of pumping various quantities of water to different elevations under the prevailing wholesale rate, namely, $20 per hp for a six-month season.

The costs are based on an arbitrarily assumed over-all pump and motor efficiency of 60 per cent. A 100-ft. lift costs $1.05 for 1 ft. and proportionately more or less for other lifts or depths.

The estimates do not include any expense other than the cost of energy. There are, however, certain operating and maintenance charges that must be added to show actual

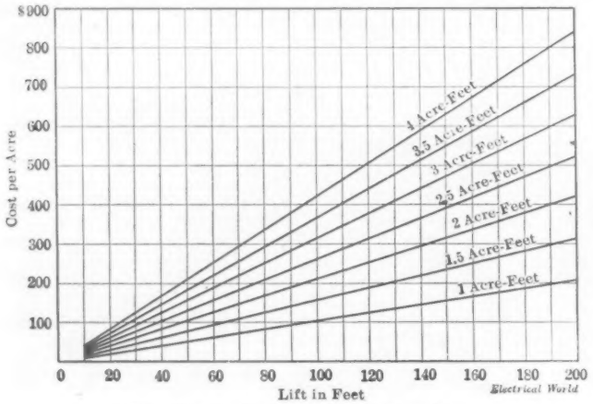


Fig. 12—Cost of Irrigation Pumping.

costs under a pumping system. No effort is made to include them here, as they are dependent upon the size and kind of plant installed.

CONCLUSION.

The remarkable growth of the pumping business during the past two or three years may be taken as a logical indication of what the immediate future development will be. Only a fraction of the land available for profitable pumping propositions has been put under water thus far. With the reclamation of the land under the lower lifts and the successful development of irrigation pumping enterprises in general will come the further development of projects taking in the higher lifts.

All these natural conditions that exist in Idaho will not only bring about a rapid growth of the pumping business, but these conditions may be taken as an indication of the

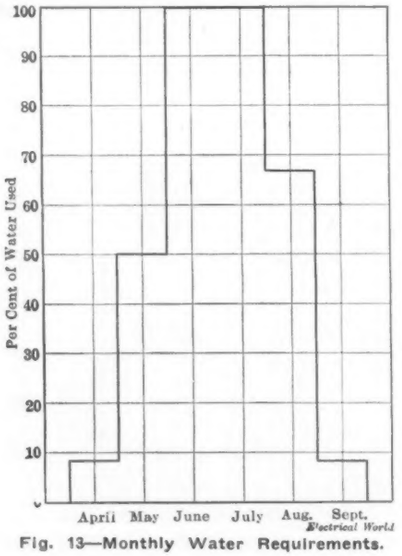


Fig. 13—Monthly Water Requirements.

growth and permanency of the central-station revenue to be derived from this source.

As the pumping load is disposed of on a wholesale basis, and as it is for the most part uniform and steady in character, it is very attractive for the central-station company. The winter heating and summer pumping loads work in well together.

QUALITY IN ILLUMINATION.

At the Niagara Falls convention of the Illuminating Engineering Society, Sept. 16-19, the general subject of quality as distinguished from quantity in illumination received an unusual amount of consideration. Below are given abstracts of papers and discussions relating to this topic:

CAUSES OF EYE DISCOMFORT.

In an extended paper Prof. C. E. Ferree discussed the effect of lighting systems on the eye. The prominent physiological effects of lighting systems are loss of eye efficiency, temporary and progressive, and eye discomfort. The author spent much time in devising accurate and reliable test methods and then undertook to determine (1) the lighting conditions that give in general the highest level or scale of visual efficiency, (2) the conditions that give the least loss of efficiency for continued work, and (3) the conditions that cause the least discomfort. The presentation of the subject in this paper was divided under three heads, as follows: (1) The scale or general level of efficiency of the eye under different systems of lighting, including the conventional tests for color discrimination, brightness discrimination and visual acuity; (2) the loss of efficiency as the result of a period of work, dwelling on the failure of the foregoing tests to indicate the loss of efficiency; (3) a preliminary study of the causes of discomfort. Discomfort seems to be a complex mixture of three experiences, each of which develops at a different time. When a lamp is turned on the first sensation is glare, and, though unpleasant, it has no painful elements. Next comes conjunctival sensation, which begins with what is ordinarily known as "sandiness" and soon becomes a sharp, stinging pain. Lastly there comes what is probably muscular discomfort, or pain and aching in the ball of the eye, which seems under continued exposure to radiate to the socket and the surrounding regions of the face and head. The periphery of the retina is more sensitive than the center; the nasal half is in general more sensitive than the temporal half, and the upper half more sensitive than the lower. In passing from the center to the periphery of the retina the sensitivity is found first to increase and then to decrease, becoming very small at the limits of the field of vision. The author promises a further statement and explanation of these results, soon to be published.

Discussion.

Dr. H. E. Ives commented enthusiastically on this paper, not only on account of the method suggested of determining fatigue of the eye, but because it showed the active interest of a psychologist of note. What illuminating engineers have needed in solving these problems are the methods of the physiologist or psychologist of experience. There was now a method suggested in Professor Ferree's paper. Mr. J. R. Cravath emphasized the need felt by the practising illuminating engineer for scientific research of the kind being carried on by Professor Ferree.

NATURAL AND ARTIFICIAL LIGHT DISTRIBUTION.

In a paper on the subject of light distribution in interiors, Mr. M. Luckiesh presented an extensive account of some of his investigations in this field. Three different test rooms of sharply different characteristics were employed, and careful tests made of the distribution of illumination, both with natural and artificial light. The author presented the results of his investigations primarily as data to be interpreted by others as they might consider proper, and drew but few conclusions of his own, in which the following were included: The measurement of illumination on a horizontal plane does not give a fair comparison of illuminating efficiencies and the distribution of illumination in various planes has considerable importance in comparing different systems of lighting. The degree of uniformity in the distribution of light about

a point under natural lighting conditions in interiors is not so great as is sometimes assumed and is frequently less than that obtained by direct or indirect lighting. Unless a room has windows on more than two sides, it is likely that indirect lighting will always produce a greater degree of diffusion and a larger illumination uniformity factor about a particular point than natural interior lighting. While extended sources aid in diffusing light, a still larger uniformity factor is obtainable by means of a distributed direct system. Extended sources, however, are advantageous in eliminating shadows and glare from glazed paper and polished objects. Daylight entering a room through windows is to a considerable extent incident upon the walls, producing a distribution of brightness much like that obtained by direct artificial lighting. In rooms with light walls the brightest spot under daylight illumination is usually on the wall near the horizontal line of sight.

Discussion.

Mr. J. R. Cravath agreed with the author on the desirability of measuring the illumination received in various directions about any given point before deciding upon the quality of such illumination for working purposes. However, he had found that the method of measuring this illumination through the diffusing test plate of a Sharp-Millar photometer could not give a true indication of the character of the illumination received, because of the diffusing action of the test plate. Measurements of the surface brightness or intrinsic brilliancy in various directions would give a much better indication of what might be expected in the shape of glare from glazed paper when used under the system of illumination in question.

Mr. A. J. Sweet called attention to the frequent mention made of the importance of diffusion in the papers and discussions at this convention and said that his investigations had convinced him that the maximum diffusion possible is necessary wherever close work is to be performed on paper. He asked why he should wish to imitate daylight. Daylight has two very desirable qualities, namely, diffusion and color, but its distribution is often not as good as artificial light. He doubted whether light distribution tests in various planes about a point would really show the quality of light for working purposes. The important point is the surface from which the light is coming; that is, whether it is a point source of light or an extended area. The problem is primarily one of getting away from light-giving sources of high intrinsic brilliancy.

VISION AS INFLUENCED BY THE BRIGHTNESS OF SURROUNDINGS.

Dr. Percy W. Cobb presented a brief paper in which an attempt was made to show the extent to which vision is influenced by the bright visible surroundings of its particular objective. The experimental method utilized was briefly as follows: An observer sitting in a dark room faced a bright surface of small dimensions, trans-illuminated from the next room. At a given moment the bright light thus seen was replaced for a short time by a field of black and white lines of the same outside dimensions and the same average brightness. By repeating the experiment with lines of various widths, the exact width of the lines can be determined which is necessary in order that they may be just visible. Similarly, instead of employing a lined surface, the original blank surface was replaced by a field of the same brightness, except that one-half of it was increased or diminished by a small fraction of its intensity. In this way the minimum detectable difference can be determined. Since the smallest visible detail and the smallest visible difference both vary with different degrees of brightness, the determinations were made for a series of seven different brightnesses from a mere glimmer up to the maximum capacity of the apparatus.

The rapid increase in the least noticeable difference at very low intensities comes out clearly in the results and also the low value for visual acuity at low intensities. The most striking feature of the results, in the author's opinion, was the fact that by all three criteria used vision at the highest intensity of test object showed a distinct improvement in the presence of the brightest visual field; that is, vision is actually improved by filling the visual field with a surface almost as bright as the test object.

Discussion.

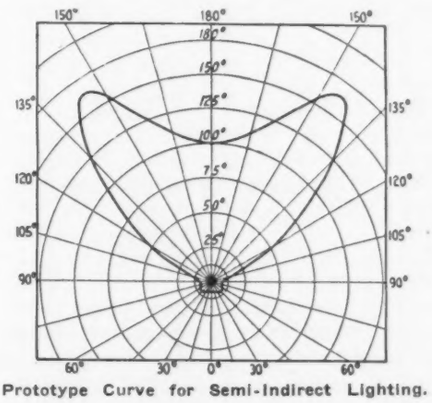
Dr. H. E. Ives told of some evidence confirming Dr Cobb's conclusions on the increase of visual acuity amid bright surroundings when the illumination on the viewed test object is high. In research work which he had done, comparing lights of different colors, it was found that it was impossible to work for more than a few minutes with the light spots which were under scrutiny amid dark surroundings. By making the surroundings light the work was made much more comfortable and could be carried on for some time.

Mr. L. B. Marks said that in practice a system of purely localized lighting with brightly illuminated spaces under the reflectors and dark surroundings had been found to be very uncomfortable.

Mr. J. R. Cravath pointed out that in part of Dr Cobb's tests the illumination of the test object and the surroundings corresponded closely to ordinary good illumination practice for artificial lighting, and within this range the results were such as to indicate that there would not be much difference between ordinary commercial colors of light and dark finished walls. He suggested that perhaps the light surroundings caused a contraction of the pupil of the eye which made a clearer image and might account for the striking results noted by Dr. Cobb. Dr. Ives, however, pointed out that this would not account for the ability to discern small differences of brightness which was involved in some of Dr. Cobb's tests.

PRINCIPLES OF INDIRECT AND SEMI-INDIRECT LIGHTING.

A paper entitled "The Engineering Principles of Indirect and Semi-Indirect Lighting," by Mr. Thomas W. Rolph, contained a discussion in detail of the desired ratio between the direct and indirect components of light used in illuminating reading pages. In making the tests to determine this ratio the surface of a desk was kept illuminated at an intensity of 3 ft.-candles, while the proportion between direct light received from the central lighting unit and indirect light received from the ceiling was varied. The observers were instructed to state when specular reflection became perceptible, when it became perceptibly



Prototype Curve for Semi-Indirect Lighting.

annoying, when it became decidedly annoying and when it became sufficient to prevent reading the printing on two kinds of paper, one having an appreciably glazed surface and the other a diffusely reflecting surface. As a result of the observations, the author concluded that the engineering advantages of semi-indirect lighting are obtained to their fullest degree and most efficiently if the lighting

unit possesses a candle-power distribution curve such that the flux below 60 deg. from the nadir is 6 per cent of the total flux; that the candle-power values between 60 deg. and 105 deg. are low, while above 105 deg. they increase to a maximum at 145 deg. with approximately uniform ceiling illumination between 145 deg. and 180 deg.

Discussion.

Mr. L. B. Marks condemned indirect lighting for a number of cases and showed that reflection from paper is not altogether absent with it. He cited one case of a drafting room with a fairly evenly illuminated ceiling with indirect lighting, where it is impossible to work on the glossy side of tracing cloth at night because of the reflection from it. Mr. J. R. Cravath said that it is a mistake to suppose that specular reflection from paper is altogether absent with indirect lighting. It is, however, much reduced compared with a direct system, unless a direct system can be adopted with the lamps in such positions in reference to the work that this type of reflection will be avoided. Mr. W. F. Little said that with a direct component as low as 15 per cent there would be no more shadows with semi-indirect lighting than with totally indirect. Mr. S. G. Hibben, of Pittsburgh, pointed out that in some kinds of work shadows are required, as, for example, in engraving. At times they are also desirable in residences to bring out decorations. Mr. M. Luckiesh pointed out that it will make a difference whether the direct light is received from 1 sq. in. or from 100 sq. in. This, he said, might alter Mr. Rolph's conclusions. Mr. E. D. Edwards pointed out that specular reflection from paper is less with indirect lighting, but what there is may be harder to escape from because of the large area from which the light comes to the paper. Mr. D. McFarlan Moore said that the indirect system had grown in popularity on account of the shortcomings of present direct systems. Vacuum-tube lighting would afford a happy medium.

Mr. Spaulding, of Cleveland, said the efficiency of the indirect system is too low for many kinds of lighting. He cited a test made on a 20-ft. by 40-ft. room lighted with eight units direct and indirect. The results were as follows: Direct, 3.52 lumens per watt; semi-direct, 2.77 lumens per watt; indirect, 1.74 lumens per watt.

Mr. C. W. Jordan pointed out an error in Mr. Rolph's assumption that all commercial ceiling surfaces are perfect diffusers. Coatings prepared with oil or varnish give much specular reflection, as shown by his paper of the day before. Mr. L. B. Marks emphasized the point that it was the glossy side of the tracing cloth with which he had experienced difficulty under the indirect-lighting system.

FURNACE EFFICIENCY.

At a meeting of the Western Society of Engineers, Chicago, on Sept. 23, Mr. Joseph Harrington presented a paper on "Furnace Efficiency," pointing out that the furnace factor is the controlling element in combined efficiency. The author also undertook to show that a heat balance on the basis of coal fired is necessary for the complete understanding of efficiency losses and that furnace efficiency is the key to high boiler-room economy. Furnace efficiency, he said, is independent of the rate of combustion, adding that a horizontal combined-efficiency curve is possible of approximate attainment. The paper included curves showing the relation of flue temperature to boiler output, influence of moisture in coal, relations between furnace efficiency, excess air and loss of carbon-monoxide, calculated combined efficiencies, and relation between draft and capacity. A number of concrete tests and examples were cited, together with the calculations by which the author's results were deduced. The coking chain-grate stoker made by the Green Engineering Company was also described in detail, especially in its application to the combustion of certain coals. The paper was discussed by Messrs. W. L. Abbot, J. C. Peebles, T. A, Peebles, T. A. Marsh, A. Bement and Alfred Saxe. In closing the author called attention to the practical fact that, while efficiency may be slightly reduced by forcing boilers beyond their rating, this sacrifice is much more than offset by the saving made in investment and banking of boilers otherwise necessary to meet the demands of a varying load.

RECLAIMING 2 MILES OF EAST ST. LOUIS SHORE LINE WITH CENTRAL-STATION ENERGY.

Within the next two years 6,000,000 cu. yd. of material dredged from the bed of the Mississippi will be used to create 2 miles of new river front at East St. Louis, Ill., both this made land and the present flood ground behind it being elevated well above the high-water level of the stream.

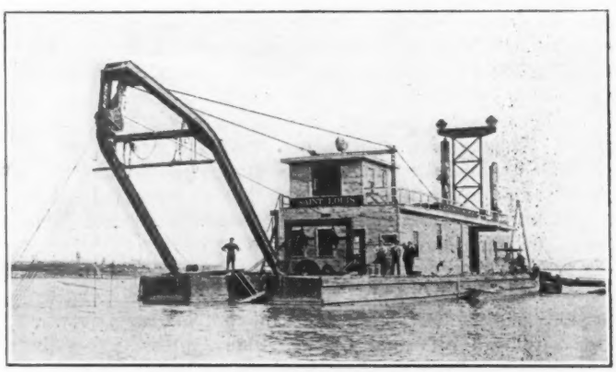


Fig. 1—1500-hp Electric Dredge "St. Louis."

The dredge performing this work is motor-driven by central-station energy from the lines of the East St. Louis & Suburban Railway Company, which lights East St. Louis, and the outfit has been in operation since Aug. 15 with entire success. Twenty-four-hour working seven days a week is the rule, making the load a desirable one for the central station. Service is measured at the power house, the construction company bearing all losses of the 2-mile, 13,200-volt, 25-cycle transmission line. The rate is based on the maximum fifteen-minute demand during the month, plus

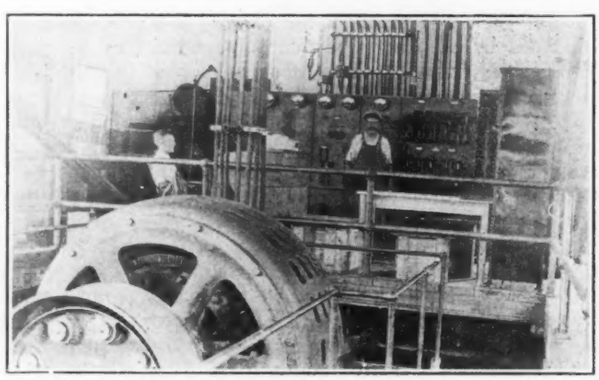


Fig. 2—1000-hp Pump Motor and Dredge Switchboard.

a unit charge per kilowatt-hour consumed. For last month's operation the demand of the dredge outfit was about 1200 kw.

The accompanying diagram and illustrations make clear the method of conveying energy to the 1000-hp main pump motor and auxiliary apparatus on the dredge. A 13,200-

volt, 25-cycle, three-phase transmission line skirts the present shore line. From this is tapped the 600-ft. cable leading to the transformer barge. An aluminum-cell arrester, mounted a few poles back of the tap, and choke coils in each cable-conductor tap protect the equipment from lightning. This cable is of the armored submarine type and contains three No. 4 conductors. The transformer barge, which is usually anchored near shore, carries a 9-ft. reel (on which the 13,200-volt cable terminates), three 400-kw, 13,200-to-2200-volt transformers and the switchboard. Connecting the transformer barge with the dredge is a 1200-ft. length of armored-submarine 2200-volt, three-conductor, 350,000-circ. mil cable. While entirely adapted for submersion, this cable is for convenience strung along over the steel pontoons which carry the 20-in. discharge pipe. Another 9-ft. cable reel, similar to that on the transformer barge, takes up slack in the 2200-volt cable. The shafts of both these reels, extending into the deck housings, carry sets of 20-in. slip-rings, from which brushes convey the current to the switchboard busbars. Practically all the motors on the dredge are 2200-volt machines.

MAIN DREDGE PUMP.

The main dredge pump is driven at 375 r.p.m. by a 1000-hp slip-ring motor, with drum type controller. This pump has a 20-in. discharge, and can deliver about 500 cu. yd. of solid material per hour. Pumping river silt, the solids handled comprise from 15 to 20 per cent of the total fluid discharge. Besides its starting resistance, this motor is arranged with continuous-duty resistors for 15 per cent speed reduction. These resistor grids are mounted in the roof of the cabin. While this speed reduction is available in case of overload on long discharge-line deliveries, the motor is now being run at normal rating. To operate the cutter head which precedes the intake and loosens bottom material, a 75-hp slip-ring motor with 14-point controller and heavy starting rheostat is provided. This motor is double geared to the cutter shaft, which moves with the pivoted ladder structure.

Although without propeller power for navigation, the dredge advances ahead when at work, by the aid of spuds and head lines. At the stern are a pair of Oregon fir spuds, huge perfect timbers, 30 in. in diameter and 50 ft. long, shod with steel points. One spud is dropped into the river bottom at a time, and with it as a pivot the lever man swings the dredge and cutter into new "ground" with the aid of the sheaves on the head lines. After successive swings back and forth, finally cutting down to the 30-ft. level, the second spud is dropped while near the end of a swing, the first raised, and the dredge is thus "walked" ahead for cutting into new material. These various motions of handling spuds, head lines, stern line, cutter ladder, etc., are performed by a 75-hp, 500-r.p.m. motor through seven Lidgerwood hoist drums, which are individually clutched and braked by means of air cylinders controlled from valves in the lever man's pilot house.

AUXILIARY EQUIPMENT.

In addition to the above 2200-volt equipment, there are two 35-hp, 2200-volt motors driving Morris service pumps, which provide water packing for pipe-line joints, and two 10-hp, 2200-volt bilge pumps, besides the air-compressor motors. A 30-kw, 2200-to-115-volt, three-phase transformer furnishes deck-lighting service and also energy to operate the 2.8-kw motor-generator set which supplies 80-volt direct-current energy to the 18-in. search-lamp above the pilot house. With the aid of this lamp work is continued all night long, and the dredge need never be shut down except to change the pontoon discharge line.

Compared with steam dredging, the motor-driven outfit has the advantages of lower first cost, requiring less space and reducing the cost of the dredge. The apparatus is more flexible and easily handled, and likelihood of shut-down or interruption is less. With the muddy water of the Mississippi, steam dredges must shut down to clean boilers at least once a week. Troubles of transporting coal to the dredge are also avoided by using central-station power.

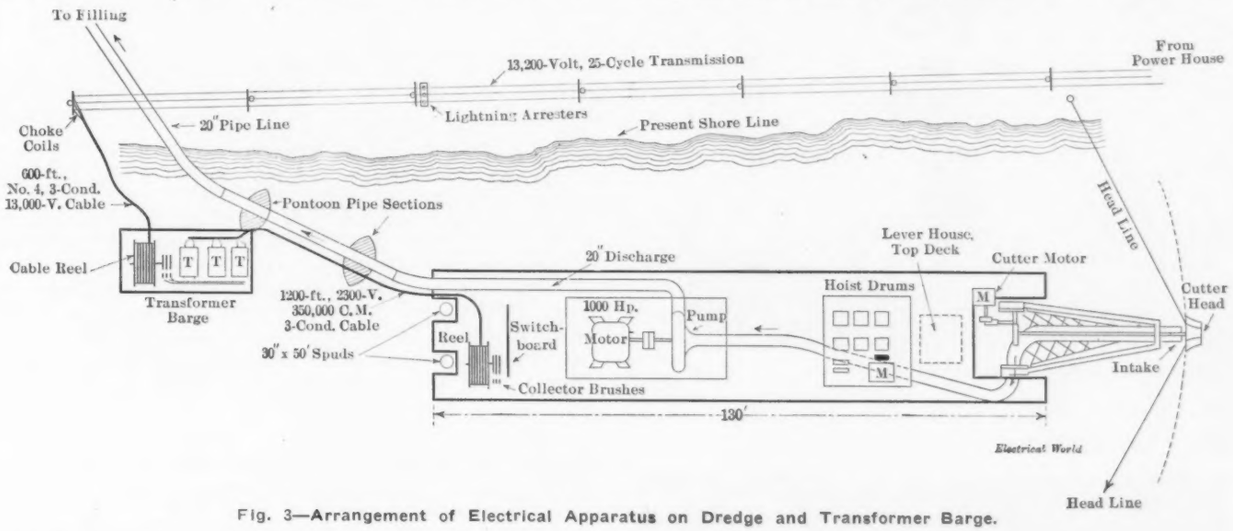


Fig. 3—Arrangement of Electrical Apparatus on Dredge and Transformer Barge.

The work of filling in the 2 miles of level north from the new municipal bridge is being done for the Terminal Railroad Association, which owns the riparian rights. The Kinser Construction Company, St. Louis, is the contractor and devised the present interesting method of handling the work. Mr. S. W. Fox is chief engineer for the work, and Mr. H. J. Muehlman is electrical engineer. The electric dredge *St. Louis* was built by the Morris Machine Works, Baldwinsville, N. Y., all electrical equipment being furnished by the General Electric Company.

FIRE ENGINE USED TO THAW CABLE DUCTS.

In a Western city last winter it became necessary to pull some cable from a dozen blocks of underground duct which had frozen up as a result of the severe weather. The old cable was in cement-lined conduit which had been in the ground for a number of years and was badly out of alignment. Mud and water had collected in the depressions and, solidifying, held the cable fast. Several methods of melting the ice were suggested, the first plan proposed being that of sending a heavy current through the cable and sheath. It was feared, however, that the lead covering might be

damaged by this procedure, so that the use of steam heat to melt the ice was decided upon. A fire engine was borrowed from the city department and stationed over the first manhole outlet, a hose from its steam line being led directly into the cable duct. With this equipment an average of a 300-ft. block was freed each day, so that the job was completed in about ten days. The engine was moved from day to day, the old cable being pulled out as rapidly as the ice was melted and new conductor drawn in in its place.

MOTOR-DRIVEN IRRIGATION PLANT NEAR LODI, CAL.

One of the illustrations below shows a typical installation of motor drive replacing a gasoline engine formerly em-

Fig. 1—A Typical Transformer Installation Near Lodi, Cal.

ployed to do irrigation work on the distribution system of the Western States Gas & Electric Company, the general

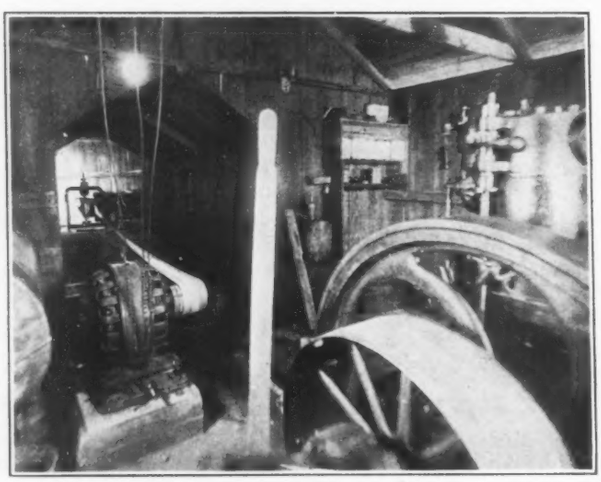


Fig. 2—Interior of Pumping Plant, Showing a 20-hp Motor Displacing a 30-hp Gasoline Engine.

offices of which are at Stockton, Cal. The Cutting Packing Company, which owns this pumping station near Lodi, Cal., originally installed a 30-hp gasoline engine. When central-station energy became available this drive was altered, a 20-hp motor being installed to drive the vertical-shaft centrifugal pump. The electric method of irrigation has not only proved to be cheaper than gas-engine drive, when all items of expense are included, but it avoids the troublesome delays and interruptions incident to operating a small isolated power plant. The packing company operates several such irrigation plants in its orchards. Other installations in the vicinity are used to supply water for almond orchards

Fig. 3—Pumping Plant Located in an Almond Orchard.

and alfalfa fields. Motors for this duty range from 5 hp to 25 hp. Fig. 3 shows a plant containing a 3-in. centrifugal pump. This outfit is located in an almond orchard with alfalfa planted between the trees.

Seven hundred farmers are now supplied with central-station energy from the transmission system of the Western States Gas & Electric Company, which has a connected load of nearly 2000 hp in pumping installations. The company's network of secondary lines covers 80 sq. miles of the best farming territory. Projected extensions will bring this total area up to 200 acres. Products of the vicinity are celery, potatoes, asparagus, onions, beans, grapes and fruits. Rates for irrigation service are as follows: First 1600 kw-hr., 3 cents; second 1000 kw-hr., 2.5 cents; third 1000 kw-hr., 2 cents; fourth 1000 kw-hr., 1.5 cents.

H. M. Byllesby & Company, Chicago, are managers of the Western States Gas & Electric Company, Mr. W. W. S. Butler being local general manager.

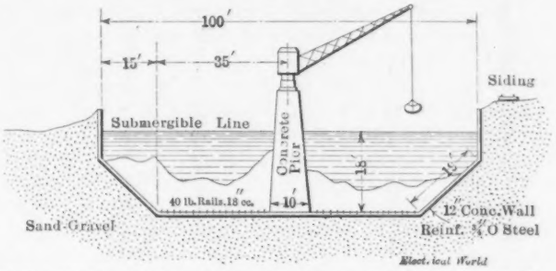
UNDER-WATER COAL-STORAGE PIT FOR INDIANAPOLIS.

An under-water coal-storage pit, 300 ft. long, 100 ft. wide and 20 ft. deep, capable of holding 25,000 tons, of which 15,000 tons can be submerged, is now being constructed for the Indianapolis Light & Heat Company at its Mill Street turbine station. Fuel will be discharged into the storage pit by dump-bottom cars from a trestle carried down the center on concrete piers and will be taken out, as needed, by a locomotive crane, clamshell bucket and cars running on the same track. The cost of handling the coal will thus be limited to one transfer, the pit being filled by gravity. The trestle connects directly with the track hopper leading to the plant conveyor, and after the locomotive crane has filled the cars on each side of it the train will be conveyed to the hopper house, emptied and returned for a fresh load.

The rectangular section of the prism excavated has been modified by leaving 19-ft., 45-deg. inclined surfaces along the bottom. This accomplishes a double result. Since the natural slope of the outside gravel material is followed, the concrete lining need not be built as a retaining wall to hold back the excavated material. A shorter boom for the locomotive crane is also made possible, since as the coal is

removed from the pit all the fuel beyond the 35 ft. line will run back within the bucket radius. A 12-in. lining of concrete will be applied to the entire surface, extending this concrete as a wall 6 ft. above the ground level at the sides. Half-inch and ¾-in. round steel section is to be used for reinforcing. As armor to protect the concrete bottom against the impact of the bucket, 40-lb. rails will be embedded up to their heads in the floor, at 18-in. intervals. The central trestle construction is designed to carry the heaviest rolling stock. Excavation for the pit is already completed, and the placing of concrete has begun. The basin should be ready to receive coal by Nov. 1.

Completed, this under-water coal-storage pit will represent an investment of about $20,000, according to Mr. T. A. Wynne, vice-president and general superintendent of the



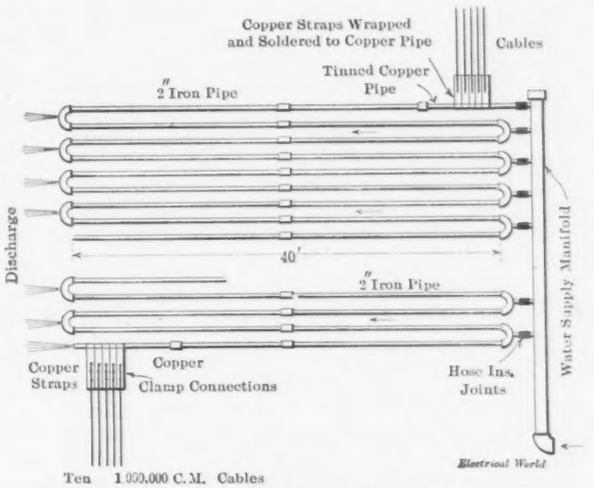
Under-Water Coal-Storage Pit for an Indianapolis Station.

Indianapolis Light & Heat Company. The excavation contract was let for $6,000. The sand and gravel removed is piled near the pit, and will be used for concreting this and other work, including the reinforcement of poles which the company now makes its practice. For similar gravel $2.50 per load was formerly paid. The excavated material can be delivered to the job for $1 a load, thus netting $1.50 saving. Reinforcing and rails for the pit walls cost $2,000, and 3000 bags of cement at $1 per bag cost $3,000. The remainder is represented by labor and by the equipment for handling the fuel. Under-water storage of coal prevents the spontaneous firing prevalent with fuel containing sulphur and diminishes the loss of heat units when the coal is to be stored for long periods.

WATER-COOLED IRON-PIPE RHEOSTAT CAPABLE OF DISSIPATING 1500 KW CONTINUOUSLY.

For testing a large substation storage battery at St. Louis it became necessary to provide a rheostat capable of dissipating continuously the power represented by 5000 amp at 300 volts. A water-cooled pipe-grid type of resistor was decided upon, the iron pipe to act as the conductor while being cooled by a flow of water. Preliminary experiments and calculations indicated that about 600 ft. of 2-in. pipe would be required. The rheostat was assembled as shown in the sketch, forty-seven 20-ft. lengths of double-strength 2-in. pipe being coupled in 40-ft. pairs and connected by standard pipe returns, making a total length of 569 ft. of pipe. It was soon found that the rheostat could not be cooled sufficiently by passing water from end to end through the 569 ft. of pipe, so it became necessary to tap holes in the return fittings, threading one set and inserting nipples to hold the hose connections to the manifold water-supply pipe. From the other ends the water was allowed to escape and waste.

A serious problem was next presented in making an adequate connection between the battery leads and the iron pipe. The connections between the battery bus and rheostat consisted of ten 1,000,000-circ. mil cables 30 ft. in length on each polarity. The attachment was made by bending ten 4-in. by ¼-in. copper straps around a 1-in. copper pipe, soldering them to its tinned surface. To the flat lugs thus provided the cables were securely clamped. An ordinary pipe fitting connected the copper tubes with the main rheostat pipe. Water circulating through the copper kept it at a workable temperature and prevented the solder from melting. With this rheostat the 5100-amp output of the battery was satisfactorily dissipated during



Water-Cooled Pipe Rheostat for Testing Storage Battery.

the rated one-hour discharge, 1310 cu. ft. of water being used for cooling. Local hot spots in the pipe were quenched by playing with a hose or loading on snow. The pipe grids rested on bricks placed on sawhorses to prevent the wood from charring.

For a six-minute test of the same battery at a discharge rate of 21,000 amp, two 3-in. pipe sections were connected in parallel, one section being 154 ft. and the other 161 ft. long. Resistance was cut out, as needed, by bridging short-circuiting copper straps across the iron pipe. For the six-minute test at an average 20,000-amp discharge, 319 cu. ft. of cooling water was required. The rheostat was designed and the tests carried out under the supervision of Mr. K. H. Hansen, electrical engineer for the Union Electric Light & Power Company.

THE PROBLEM OF THE SMALL ELECTRIC-LIGHT COMPANY.

The problem of supplying electric-lighting service to the average small town is a very difficult one to solve so as to satisfy the people of the town and also the stockholders of the company, according to the view of Mr. R. S. Stewart, expressed in a paper read before the recent convention of the Michigan Section of the National Electric Light Association. The total amount of business is limited, usually being less than $3 per capita. The customers have small bills and use no more lamps than are necessary. The habits of the people are all very similar and there is therefore not as large a diversity factor as is found in the large cities. The maximum load is small, probably in the neighborhood of 30 kw per 1000 inhabitants.

In order to keep the fuel bills down to reasonable limits and also to keep the investment as low as possible, most small plants are content with one engine and generator of a size sufficient to carry the maximum load. No spare machine is installed. As a result of this practice the machine is operated under very inefficient conditions after 11 o'clock at night, and in some towns the companies go so far as to shut down at midnight in order to cut down operating expenses.

The question of labor is very serious, for one man is expected to operate the plant at night without the assistance

of a fireman, make all the necessary repairs in the daytime, do all the wiring, order supplies and, in fact, be a man-of-all-work. With all these qualifications he must be content with a salary which is usually less than that of a fireman in a large plant. The consequence is that the plant is not kept in the same efficient state as are the plants in the larger cities.

What the small town needs is not an engineer who will install a plant of the highest efficiency possible, but an all-around man who will use common sense and will so arrange the plant that he can obtain the greatest possible amount of revenue without increasing the expenses to a prohibitive point. Where small towns are not too far distant from other towns it is more profitable for several small towns to combine into a single system than for each town to work out its problems independently of the others.

IMPROVEMENT IN STEAM TURBO-GENERATORS.

According to the report of the committee of the Association of Edison Illuminating Companies on steam turbines, based on information supplied by the manufacturers, a number of developments and improvements have been made recently in Westinghouse steam turbo-generator practice. Speed limits have been materially raised within recent times in both 25-cycle and 60-cycle practice. In 60-cycle practice generators of 5000 kva rating at 3600 r.p.m. have been built, which is considerably larger than had been completed a year ago. For machines larger than 5000 kva four poles are being used up to approximately 20,000 kva, whereas a 10,000-kva generator was about the largest machine yet built with four poles up to a year ago.

In 25-cycle practice, two-pole, 1500 r.p.m. machines are being built in sizes up to 20,000 kva, and it is probable that the ratings will be carried up to 25,000 kva or possibly 30,000 kva, although at these ratings other factors than the design of the turbo-generator itself may control the speed conditions. It may be said, however, that the generator itself is practicable up to 30,000 kva at 1500 r.p.m. At 750 r.p.m. it is hard to say what the upper limit will be.

Some of the most radical improvements in the later high-speed turbo-generators have been in the methods of ventilation. In the older Westinghouse practice practically all the ventilation of the machine was through the air-gap between the rotor and stator. On the more recent machines, especially where the speed limits have been raised, it is not practicable to force sufficient cooling air through the air-gap alone, and therefore additional ventilating channels are provided and particular provision is made to prevent the currents of cooling air in the various paths from interfering with each other. In particular, the air passages are arranged with a view to cleaning them without dismantling the machine. Methods have also been devised for effectively cooling machines which have a comparatively great length compared with their diameter, and thus, it is claimed, a long machine of very high rating can be cooled as effectively as a short one, which has not been usually the case.

In the more recent machines of very large outputs the rotor is made up of rolled-steel plates which are rigidly and permanently clamped together, without a through shaft, to form the rotor body as a whole. This core is then suitably slotted for the rotor windings and for purposes of ventilation. The rotor windings consist of formed strap coils insulated with mica and asbestos, so that they can withstand an excessively high temperature under emergency conditions. Tests made with this type of insulation are said to have shown that it can successfully withstand temperatures higher than that of the melting point of tin solder.

As far as the records show, the manufacturer claims that there has never been a failure of the insulation with the Westinghouse mica-wound rotors due to deterioration by temperature, although a large number of such rotors have been employed in commercial service for a number of years.

On account of the higher speed limits with large machines, the methods of supplying cooling air have required more or less modification recently. For instance, a 60-cycle, four-pole machine of 20,000 kva rating will not have a materially larger diameter of rotor than a 10,000-kva machine of the same speed, although the amount of air required for cooling must be twice as great. In the 10,000-kva machine, a ventilating fan of the largest permissible dimensions may be installed directly on the rotor shaft, and the opening through such fans may be just sufficient to force in the required amount of ventilating air. Therefore, on the 20,000-kva machine it may be impracticable to obtain enough opening through a ventilating fan of the largest practicable dimensions to allow the necessary air to be supplied to the machine, and hence some other method of ventilation becomes necessary or desirable. In consequence, on very large high-speed turbo-generators separate blowers are coming into use, these blowers being designed for any suitable speed and driven by electric motors. When a number of large turbo-generators are located in one station the ventilating fans can supply air to a large air chamber which opens to all the machines. This scheme is somewhat more economical than with blowers directly on the machines, as the fans can be operated at the most economical speed, and furthermore, if the fans are driven by motors with adjustable speed characteristics it is possible to vary the air pressure, depending upon the requirements of the load, so that further economy is thus obtained.

The Westinghouse company countenances the use of voltages up to 11,000 volts and 13,000 volts directly on the armature winding. Two principal difficulties incident to the use of high voltage on the armature winding—namely, dangerous heating in that part of the copper buried in the core, and deterioration or "eating away" of the insulation by static discharges—have both been overcome by the use of mica insulation on the buried part of the coil, this insulation being put on individual turns as well as on the outside of the coil as a whole.

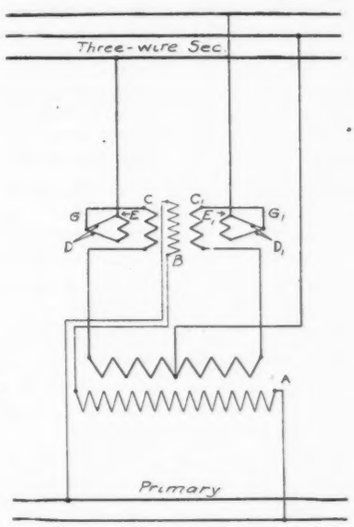
The end windings of Westinghouse machines, it is said, have been braced in a still more rigid manner than in the past, so that no danger is anticipated from dead short-circuits across the terminals of such machines without external reactance in series. The Westinghouse company designs its turbo-generators with a relatively large internal reactance, sufficient to prevent damage to the machine in case of a dead short-circuit across the terminals. This usually means from twelve to eighteen times full load current at the first instant of short-circuit. If for any reason outside the machine itself it is necessary or desirable to reduce still further the short-circuit current, it is recommended that this be done by means of external reactors. By this expedient a certain amount of adjustment is possible to meet external conditions, while the machine is able to protect itself regardless of the use of additional reactors.

REVOLVING MOLDS FOR CONCRETE POLES.

Concrete posts for carrying electric-light and trolley wires across the new Avenue Twenty Bridge, Los Angeles, Cal., are being constructed by the centrifugal method under German patents. The mold is revolved rapidly while the concrete is being poured, throwing the material into the outer edges of the pattern. Motion is continued while the concrete is setting, holding the material under centrifugal action until it has become thoroughly fixed. Reinforcing bars are placed in the molds in the usual way near the outer surfaces of the concrete. Posts formed in this way are declared to be stronger than those in which the concrete has set under ordinary conditions, but the cost of the centrifugal method is greater. Mr. Homer Hamlin is city engineer in charge of the bridge construction.

PROTECTING SECONDARY NETWORKS AGAINST DEFECTIVE TRANSFORMERS.

In a paper presented before the annual convention of the Association of Edison Illuminating Companies at Hot Springs recently, Mr. S. D. Sprong, of the Brooklyn Edison Company, described a method of eliminating a defective distributing transformer on primary circuits without allowing it to remain as a short-circuit on the secondary network. In approaching this problem, the author and Mr. W. E. McCoy, of the United Electric Light & Power Company of New York, dismissed from consideration differential relays with contacts and all of the variety of other devices that are suitable for interior work. By this process of elimination there was left but one protective device that might be employed, namely, the fuse; but unfortunately the fuse has no sense of discrimination in the direction of the flow of current. Therefore it remained to utilize the fuse in such a way as to make it respond to reverse power, regardless of direction. Apparently the only means of doing this was to superpose on it a current resulting only from the reversal of load. It then remained so to connect this fuse that when ruptured by reverse power it would disconnect the transformer secondary from the network. This was accomplished by connecting the transformer to the center of the fuse and one of its terminals respectively.



Fuse Connections.

The connections of the device for a three-wire network are shown herewith. The commercial transformer is shown at A, one terminal of the primary being connected in series with a coil B of the series instrument transformer. The terminals of the secondary of the commercial transformer are connected through coils C and C_1 on the series transformer. These latter coils are connected to the middle point of the looped fuses D and D_1, one side of which is connected from E and E_1 to the outer conductors of the three-wire network. The fuses D and D_1 act as a short-circuit connection on the coils E and E_1. Under normal conditions the primary B and secondary coils C and C_1, having the same ampere turns and being connected in opposition, will neutralize each other so that there will be no mmf circulating in the core of the series transformers to energize the coils E and E_1. This balance of conditions is maintained at all loads and is only upset by a reverse current flowing from the secondary network into the transformer such as is occasioned by a short-circuit in the latter. Such a condition reverses the relative polarity of the coils C and C_1, thus energizing the core and causing a heavy short-circuit current to flow through the coils E and E_1 by way of the short-circuiting fuses D and D_1. The heavy short-circuit current through the fuse immediately ruptures them and isolates the main terminals at G and G_1.

This device has been built and tested in transformers ranging from 5 kw to 50 kw, two-wire and three-wire. It operates so nearly instantaneously that it does not blow the primary fuses in transformers immediately adjacent. The fuses D and D_1 each carry the secondary current and under normal working conditions are so proportioned that they will not blow from overload. Their current-carrying capacity compared with the full load of the transformer is not less than five to one. In other words, the short-circuit current available to blow this fuse in case of reversal is at least five times the full-load secondary current of the transformer. Various tests have been made in the degree of short-circuit in the commercial transformer, varying from a direct short-circuit across its primary terminals to a partial short-circuit on the secondary winding. The protecting fuses D and D_1 blow in every case and almost instantaneously even on the minor short-circuits in the secondary of the transformer. According to the author the device operates so effectively that on a few tests a short-circuit in the commercial transformer of such proportions as not to blow the primary fuse did blow the protector fuse. This, however, results very infrequently and was due to the very nice balance of conditions that occurred in some of the tests.

INSTALLATION OF SMALL POWER PLANTS IN FEDERAL OFFICE BUILDINGS—III.

By D. F. Atkins and H. M. Price.

In the previous articles on this subject the considerations governing the Treasury Department in the choice of the mechanical equipment of a federal building were outlined, and in order that the general practice of the Treasury Department might be understood the rules governing the size and number of units were also treated at some length. In the last article the merits of the various types of machines were discussed from the viewpoint of the special needs of the department, and as having a bearing upon the subject excerpts from the specifications for the engines and generators as prepared in the office of the supervising architect are given below.

ENGINES.

The engines required are of the single-cylinder, automatic, horizontal, side or center crank type, designed to operate non-condensing on dry saturated steam at 110-lb. gage pressure at the throttle. The speed of the 100-kw set is required to be not more than 250 r.p.m. and of the 150-kw set not more than 220 r.p.m. The engines must be designed to operate most economically when the generators are carrying three-quarter load at rated voltage and speed, but must be capable of operating the generators for two hours on 25 per cent overload at rated voltage. Foundations of 1:2:3 concrete, with the bottom not less than 4 ft. below the floor line and the top extending not less than 6 in. beyond the edge of the sub-base of the frames, are required, and the batter in the depth specified must not be less than 2½ ft. each side. A 6-in. cushion of sand is also required.

In addition to a heavy and substantial cast-iron sub-base, each engine is required to have a heavy and substantial cast-iron frame designed for strength, rigidity and compactness and equipped with suitable covers to prevent the throwing of oil or the accumulation of dust on moving parts. Long, well-proportioned, dust-proof bearings, lined with genuine babbitt metal carefully peened in place and accurately bored to gage, are specified. The main bearing must be of the removable shell type, and the outboard bearing, which is required to have large-size oil wells, visual gages and pet cocks for drawing off the oil, must be of the oil-ring type. Means for adjustment of all bearings are demanded. According to the specification each engine must be provided with an automatic, self-lubricating, continuous-circulating system, which will supply pure clean oil continuously to all bearings, etc., the operation of the system to be positive and free from the throwing or spilling of oil.

The engine cylinders must be of sufficient thickness to allow for re-boring and be well lagged with magnesia or other material having equal heat-insulating value and covered with ornamental cast-iron jackets or with Russia iron.

The piston heads must be of hollow cast iron, with at least two cast-iron snap rings with lapped joints sprung into accurately fitting grooves. The rings must override the bore of the cylinder.

Nickel steel is required in the piston rods, which must be turned to a taper at the piston ends and driven up to the shoulder and securely held by a heavy nut provided with a cotter or dowel pin. The forward ends of the piston must be secured into the crossheads and be provided with a jam nut and suitable lock to prevent turning. The crossheads must be of cast steel, equipped with adjustable bronze shoes or shoes of cast iron and babbitt. The connecting rods must be of forged open-hearth steel in one piece with solid crank pin end and crosshead end. The crosshead boxes must be made of phosphor bronze, adjustable by means of a wedge, and the crank ends must be fitted with adjustable boxes of steel or phosphor bronze, lined with babbitt metal. Open-hearth steel, forged in one piece, with counter-balancing crank disks of annealed steel securely fastened thereto, is specified for the crank shafts.

Each engine must be fitted with four valves of the semi-rotary, poppet or gridiron type, designed to be slightly unbalanced. Multi-ported steam valves, giving ample port openings for all points of cut-off, are required, the steam valves to be provided with removable bushings or cages and the gridiron valves to be provided with a suitable balancing plate. The valve mechanism must be designed to give quick and positive motion at opening and closing, and lubrication of the pins and bearings must be accomplished while in motion by compression grease cups placed at accessible points, or they must operate in oil wells.

Inertia governors of approved type are required, and each engine when operating under the conditions specified and at uniform load must not consume more than the specified amount of dry steam, which is determined by the weight of condensed exhaust steam. The following table gives the load under these conditions for 100-kw and 150-kw generator engines:

Load.	25 Per Cent.	50 Per Cent.	75 Per Cent.	100 Per Cent.	125 Per Cent.
100-kw generator engine, dry steam....	74.0	48.0	41.0	41.0	43.0
150-kw generator engine, dry steam....	74.0	45.0	40.0	40.0	41.0

The efficiency, output, etc., of each unit is determined by actual test in the presence of the Treasury Department's authorized agent, and units failing to meet the specified requirements may be rejected or the builder subjected to penalty. The regulation called for is such that with a slow change of speed from no load to full load, and vice versa, there must be not more than 1½ per cent variation, and from full load suddenly thrown on and off the variation must not exceed 2 per cent.

GENERATORS.

The generators called for in the specifications are of the direct-current, engine-driven, compound-wound, inter-pole type for 115-volt direct current, each mounted on a sub-base connected to its engine sub-base. One has a full-load rating of 800 amp at not more than 250 r.p.m., and the other a full-load rating at 1200 amp at not more than 220 r.p.m. The armatures and commutators are required to be built upon ventilated sleeves or spiders, arranged to be pressed or keyed to the shafts. The field or magnet frames must be provided with screws and liners for adjustment in position, the frames themselves being of high-grade steel or iron and the poles of laminated steel or iron, the interpoles being of steel.

The main field coils must be form-wound and be provided with ventilating ducts. The armatures are required to have slotted cores, and the windings must be thoroughly insulated and provided with ventilating ducts. Drop-forged or hard-drawn copper commutator segments insulated with mica are specified, together with carbon brushes and brush holders permitting the removal of any brush while the machine is in operation without disturbing the others. The voltage regulation specified is 115 volts no load to 115 volts full load at the switchboard, based on a variation of speed in the engine of not more than 2 per cent from no load to full load. Moreover, the design must be such that no change in voltage will occur sufficient to cause objectionable flicker of lights when the elevator motors are in operation.

The insulation resistance between frames, field coil, armature windings and brushes must be not less than 1 megohm, and the generators must be capable of withstanding a breakdown test of 1500 volts alternating current for one minute. It is required that the heating effect, insulating resistance, etc., of the generators shall be determined by actual tests in the presence of the department's authorized agent, who shall also determine the tests.

OPERATION OF MIXED UNDERGROUND AND OVERHEAD HIGH-TENSION LINES.

In the report of the committee on high-tension disturbances presented at the recent convention of the Association of Edison Illuminating Companies it was pointed out that a number of Edison companies are operating mixed overhead and underground distributing and transmission systems, embracing tensions ranging from 4000 volts to 20,000 volts. Some of these are 60-cycle circuits with tensions ranging from 4000 volts to 13,000 volts, and some are 25-cycle circuits with tensions ranging from 6600 volts to 20,000 volts. The general experience has led the companies to consider mixed overhead and underground systems as entirely practical, and as yet they have involved no unusual hazards that cannot be taken care of by standard protective devices which in themselves have proved satisfactory and adequate for the work.

One company reported that in using porcelain end bells on standpipe cable terminals a number have broken down at the end of the lead sheath. It was thought that this was due to the use of porcelain (a non-conductor) instead of metal, which localized at the end of the lead sheath a considerable static strain. This experience, in the estimation of the committee, tends to confirm the theory of Dr. Steinmetz that wherever a change takes place in the relation between inductance and capacity there is a corresponding change in superposed potentials resulting from static disturbances. The practical application of this theory is that a flaring metallic end bell causes a less abrupt gradient in the static strains localized at this point. It is sometimes the practice when using metallic end bells to allow the lead sheath to project through the neck beyond the inside of the bell. This in at least one case has resulted in breakdowns similar to those that might be expected in the absence of the bell. As porcelain cable terminals are coming into more general use, the committee feels that it would be worth while to make an experimental investigation of this interesting problem.

Referring to the use of choke coils in an overhead line where it connects to a cable system, it is stated that it has never been desirable to use such a device alone, as there is a possibility of resonance taking place between the capacity of the cable and the inductance of the choke coil. On the other hand, the choke coil is very desirable as it assists the lightning arrester in its protective functions. In order to use a reactor in this relation, it is necessary to shunt it with a certain amount of resistance, by which all of the good effects of the choke coil can be obtained without experiencing any of the ill effects which are apt to arise from resonance.

Central Station
Management, Policies and Commercial Methods

DISTRIBUTION SYSTEM DIAGRAMS.

The use of the card index record of connected loads is generally recognized as one of the best methods of keeping data of consumers' installations, and in the street-lighting field the employment of large maps showing pole and lamp locations is a common practice. In order to have all the distribution system close at hand in diagram form the Worcester (Mass.) Electric Light Company has provided for this purpose a set of 20-in. by 11.5-in. loose-leaf binders showing in numbered sheets of the white-print type the exact location in each section of the city of every pole, transformer, arc lamp, manhole, underground and overhead motor-service and lighting feeder owned and operated. Each sheet is keyed by an appropriate number or letter to a corresponding section of a city map maintained under glass in the company's general office, and the sheets are brought up to date at least once a week by the company's electrical department. Differently colored lines are used for different classes of service, and whenever an inquiry is received at the office regarding any class of service in any locality the data book instantly shows what facilities the company has in the neighborhood.

HOUSE-WIRING OFFER AT MUNCIE, IND.

By arrangement with local electrical contractors, the Muncie (Ind.) Electric Light Company offered to have prospective customers' houses wired during the month of September at the following schedule, all work to be concealed wiring, with rosettes, drop-cords, and sockets, and approved by the city inspector: Three rooms, $9; four rooms, $10.65; five rooms, $12.25; six rooms, $13.80; seven rooms, $14.35; eight rooms, $15.90; nine rooms, $17.45; additional rooms, $1.50.

This campaign has been followed up with extensive newspaper advertising in the local press, explaining the details of the house-wiring offers and setting forth the advantages of electric light.

Renting Signs Come Out When Electric Light Goes In.

Electric wiring as an investment was forcibly illustrated in one "ad" as follows: "The cost of wiring is really an investment. If you are a landlord you will find that wiring your property for electric light is one of the most profitable investments you can make. It will sell better or rent quicker. The renter who insists on having electric light is usually one who will care for your property as well as his own. Renting signs come out when electric light goes in."

To help rent untenanted houses wired for electricity, the Muncie company also maintains an illuminated display device in front of its office with moving cards carrying photographs and data of local houses for rent. For owners who furnish pictures and details the company exhibits these displays free of charge until the houses have been rented. Such electrically lighted bargains are usually snapped up quickly, so that the offerings are being continually renewed.

In addition to its meter rate the Muncie Electric Light Company also offers a controlled flat-rate proposition for residences, charging 1 cent per month for each watt of connected load, with a minimum charge of $1 for four 25-watt tungsten lamps. Nearly 1000 excess indicators are now in use in Muncie, and these flat-rate controllers, according to Mr. T. F. English, local manager, have made it possible to secure a class of customers who could never have been reached under a meter schedule.

To encourage its solicitors in closing house-wiring contracts and service orders, the company recently offered a series of prizes to representatives who turn in the greatest number of contracts. These awards are for $50, $25 and $15. Many residence contracts, if not the majority, are closed after working hours when the head of the household is at home and can be reached in consultation with his wife. To stimulate the men in putting in these after-business hours, these prizes were arranged in addition to their regular salaries.

BOSTON WINDOW-LIGHTING DISPLAY.

In connection with the opening of the 1912 Electric Show, the Edison Electric Illuminating Company of Boston, Mass., equipped its entire display window space at the main office building on Boylston Street with an electrically illuminated transparency of unusual design. The transparency consists of a 12-ft. by 25-ft. drop surrounding a 4-ft. by 8-ft. photographic enlargement from the celebrated Poole painting of "Twentieth Century Boston," the bottom of the drop containing a perforated painting of the Mechanics' Building, where the Electric Show is being held, and the upper portion a perspective map of the world, showing ships of all nations carrying passengers toward Boston. The enlargement shows the greater city viewed from an extreme elevation above Boston Harbor and contains over 30,000 perforations cut with special dies through the bromide print. About 1200 holes are also punched through the view of the Mechanics' Building, and behind the drop and the enlargement are mounted about 200 4-cp, 30-volt lamps, connected four in series, and a dozen 40-watt lamps carried in a reflector trough serving the lower portion of the display. Inside the window at the front fifty 40-watt lamps are installed in such a way as to provide a daylight effect at certain periods. The 4-cp lamps are used in the illumination of the enlargement and the larger lamps behind the drop are utilized in the lighting of the Mechanics' Building transparency.

The display operates on a two-minute cycle in which full daylight, sunset, twilight and moonlight follow each other in due course. At the beginning of the cycle the entire scene is shown in full daylight effect. The lamps illuminating the drop are then cut off, concentrating attention upon the view of Boston, after which sunset begins. As

the sky reddens the picture darkens; the State House windows are lighted, and in rapid succession groups of buildings, street lamps, boats in the harbor, bridges and the Mechanics' Building are shown in miniature with realistic illumination, which remains during the greater part of the ensuing moonlight period, at the close of which all lamps are cut out of circuit until the beginning of the next cycle. The various circuits are controlled by a single flasher of the motor-driven type, the gradations of the light flux being governed by a single Cutler-Hammer dimmer of the solenoid-operated cross-head type, requiring only one contact aside from the transfer contacts on the flasher to perform the required service. The solenoid is equipped with a double-acting oil dash-pot adjusted to hold the plunger in synchronism with the flasher. Color effects are obtained by the use of dyed tracing cloth, and even the mercury-vapor lamps used in the Boston Post Office and in several photo-engraving establishments in the city are simulated by the use of greenish paper between the low candle-power incandescent lamps and the transparency. The installation was designed and built by the laboratory department of the Edison company, the drop being painted by a scenic artist. It was placed in service after a single night's assembly work in the window and illustrates in a striking degree the convenience of electricity in securing in a comparatively simple manner effects of extraordinary intricacy and beauty.

ELECTRIC VEHICLE PERFORMANCE.

In its report to the Association of Edison Illuminating Companies the electric-vehicle committee appends a statement of average miles per vehicle, average kilowatt-hours per vehicle mile and average time out of service per vehicle as given herewith. While the committee realizes that the value of such data depends upon the conditions surrounding the service rendered, the paucity of available data on electric-vehicle service prompted it to incorporate what information it could obtain.

DATA ON ELECTRIC-VEHICLE PERFORMANCE.

Type.	Number Vehicles in Service.	Average Miles.	Average per Kw-hr. Vehicle Mile.	Average Days and Hours Out of Service.		
				Days Painting and Overhauling.	Hours Breakdown.	Hours Out of Power.
Surreys	9	5594	.7	30	5	0
Superintendent's wagons	3	6641	.7	3	16	0
Landaulets, broughams, runabouts, roadsters	10	7168	.7	26	6	0
750-lb. wagons	2	8024	.4	0	3	0
1000-lb. wagons	30	5422	.8	17	5	1
2000-lb. wagons	23	6478	1.0	7	13	1½
3000-lb. wagons	6	6899	1.0	1	7	0
4000-lb. wagons	2	7555	.8	3	7	0
2½–3½-ton trucks	4	3726	2.0*	11	20	2
5-ton trucks	6	3131	2.7*	8	18	4

*Includes windlass.

Months in Use.	Number of Automobiles.	Size.	Average per Automobile per Month, Number Days in Use.	Average Miles per Automobile per Day.	Average Kw-hr. per Mile.
12	6	700	26	25	.62
12	1	700	20	30	.09
12	6	1,000	24	21	.68
12	1	1,000	23	17	.92
12	4	2,000	20	24	1.06
12	3	2,000	19	12	1.58
12	2	4,000	20	14	1.31
12	2	4,000	15	19	1.36
12	2	7,000	23	18	1.42
12	1	10,000	23	16	1.53

The committee also places on record its opinion as to the non-necessity of presenting statistics for the purpose of proving the practicability of the electric commercial truck, although it feels that the compilation of such data is important and useful to the central station. It expresses implicit confidence in the future of the electric vehicle.

NEW RATES ESTABLISHED AT BOSTON.

The Edison Electric Illuminating Company of Boston, Mass., has recently established a new schedule of "miscellaneous energy rates," taking effect Oct. 1 and applying particularly to battery charging, electric heating, electroplating, refrigeration, water supply and irrigation service. A price of 10 cents per kw-hr. is charged under the new schedule for all energy not exceeding 20 kw-hr. a month, with a minimum of $12 per year per meter. Above 20 kw-hr. per month the charge is 3 cents, with a second deduction to 2 cents per kw-hr. for all electricity furnished in excess of 2000 kw-hr. per month, provided that the customer agrees to pay a price of 10 cents per kw-hr. for electricity used during certain hours specified from time to time by the company, but not exceeding 500 hours during the year and not exceeding four hours during any day, this amount being a separate charge independent of the energy billed at the other rates. It is further provided that whenever the monthly bill for electricity shall be less than $100 the customer shall pay $5 per month as rental for the instrument necessary to determine when he uses electricity. If the monthly bill is less than $100 but over $95, only the difference between the amount of the bill and $100 will be charged.

CENTRAL-STATION FLOAT IN CIVIC CELEBRATION.

Friday, Sept. 13, was Tin Plate Day at Elwood, Ind., in celebration of the fiftieth anniversay of the opening of the tin-plate industry and the city's prosperity. In the parade which was a feature of the celebration forty decorated floats took part, the Elwood Electric Light Company exhibiting the novel display illustrated. This float received second prize out of the forty displays, the exhibit of the tin-plate company itself being awarded first.

Float of Elwood Electric Light Company.

The central-station float carried two short poles with a span of transmission line from which were tapped drops to the electric devices exhibited. At the front was a little boy in cook's uniform before a toaster, who distributed to the crowd a thousand pieces of toast previously prepared and wrapped in tissue. Next was a little girl costumed as a

laundress at work over an ironing board. Near the rear sat two little people dressed as old folks, reading by electric light to illustrate its value in conserving eyesight. A pile of small motors formed the tail-end of the float, while overhead, perched on the rear pole, was the nine-year-old son of Manager N. M. Argabrite, in complete lineman's rig, with spurs, climbers, safety belt, etc., pounding away on the pole and cross-arm. Insulators, knobs, tubes and cleats made up the decorations at the side of the float and the drivers were seated on rolls of wire. Banners bore the legends "We turn the wheels of progress" and "Children are safe in the electrical home."

MEMPHIS ELECTRIC VEHICLE CHARGING SERVICE.

On account of the activity of the Memphis Consolidated Gas & Electric Company in providing a place where the electric vehicle cars receive proper attention and in advertising it at every opportunity, the number of cars in active service in this Tennessee city has been doubled in less than one year. According to Mr. A. N. Bentley, who read a paper on the subject before the recent convention of the Georgia Section of the N. E. L. A., a year ago there was no garage in the city where an electric vehicle could be taken care of. There were in use a considerable number of antiquated machines, constantly in need of repair, which represented a source of annoyance and expense to their owners but were kept in service on account of the urgent demand for a clean and odorless machine to be driven with ease and safety by women. Finding that the existing adverse conditions were causing a decrease in the number of electric cars in service, the Memphis Consolidated Gas & Electric Company opened a garage, in its own name and under its own management, exclusively for electric vehicles. It is believed that many central-station managers are interested in the methods and results of the company's activity in this direction. The company established fixed charges for its services, as follows:

Full service, per month	$25.00
Full service less delivery, per month	20.00
Vehicle care and oiling, per month	10.00
Battery care, per month	7.50
Trucks, 1,000 lb. to 3,000 lb., full service	20.00
Charging energy on above contracts, per kw-hr	0.05
Charging energy (no contract, $1 minimum), per kw-hr	0.10
Dead storage, per month	7.50
Wet storage, per month	12.50
Single wash, day	1.00
Single wash, night	0.75
Battery and car labor, per hour	0.75
Single call or delivery	0.25

In eight months after opening this garage the company was forced to increase its floor area from 6500 sq. ft. to 11,500 sq. ft. It now has twenty-six charging plugs and a daily energy consumption load of over 600 kw-hr. It is charging eleven commercial vehicles and thirty-four pleasure cars. All but two of the commercial machines have been placed in service since the garage was opened.

THE USES OF ELECTRICAL ENERGY IN FARMING.

A demonstration was recently made of the uses of electrical energy in farming operations on the farm of Mr. J. W. Might, near Cooksville, Ontario, which is served from the distribution system of the Ontario Hydro-Electric System. The applications of electric power to threshing grain, operating milking machines, cream separators and miscellaneous farm machines were shown, and demonstrations of electric cooking and other domestic uses for electrical energy were made. The Hon. Adam Beck, chairman of the Ontario Hydro-Electric Commission, addressed the assemblage of farmers and told his hearers that an epoch in the agricultural life of the Province of Ontario is at hand. He pointed out that means are now available for doing away with the old-fashioned labor-wasting methods by the substitution of electrically driven machinery. The farmers of Ontario should become, as the farmers of Germany and Switzerland have already become, not merely husbandmen but mechanics. It was pointed out that, while the German farmer can obtain an abundance of labor at low wages and while his energy supply costs more, he finds it, nevertheless, to his advantage to employ electrical energy for nearly all purposes. Mr. Beck dwelt at some length on the cost of such electrical service and pointed out that the diversity of individual demands would automatically tend to reduce the cost of service. He also pointed out that the purchase and use of electrically driven threshing equipments on a co-operative basis would reduce the investment by each individual farmer and thus bring the advantages of this service within the reach of all for a moderate outlay.

COMPARATIVE COSTS OF HORSE AND ELECTRIC DELIVERY.

New-business managers of central stations will find much valuable information in a compilation herewith shown of comparative costs of delivery operation with battery-driven trucks and with animal traction made by a well-known manufacturer to show the increased radius and diminished cost of operation, both per mile and per ton-mile, to be obtained from electric vehicles, with approximately the same daily outlay. The expense of operating electric automobiles is, of couse, much lower than that of either horse-drawn or gasoline vehicles. The table includes the stabling costs of horses, etc., required to draw the 1500-lb., 2-ton and 5-ton loads, the rated capacity of the trucks with which they are contrasted, and it makes clear the longer daily travel possible with electric drive and its effect on the lower cost per mile and per ton-mile.

COMPARATIVE COSTS OF ELECTRIC AND HORSE TRAFFIC.

	1500 Lb.		Two-Ton		Five-Ton.	
	Horses.	Electric.	Horses.	Electric.	Horses.	Electric.
Miles per day	17	30	16	30	12	24
Ton-miles	12.75	22.50	32	60	60	120
Cost per day	$6.00	$6.63	$8.37	$8.50	$9.10	$11.00
Cost per mile	0.35	0.20	0.52	0.283	0.76	0.458
Cost per ton-mile	0.466	0.267	0.26	0.14	0.15	0.091

CO-OPERATIVE MESS COMMITTEE OF CONSTRUCTION GANG.

During the construction of the 18-mile 33,000-volt transmission line connecting Muncie with Alexandria, Ind., the construction crew has been fed on a co-operative plan, at a weekly cost of $1.50 to $1.75 for each man's board. The electric company furnished the services of the cook and his culinary equipment, and the men appointed a mess committee of three, who supervised the purchase of provisions and selection of the menu. The course of the line lay through a rich farming country, so that meat and vegetables, butter, milk, eggs, etc., were purchased at low prices directly

from the farmers. At the close of each week the expenditures for supplies were totaled and divided equally among the thirty-five men fed, the amount, averaging $1.60 per week, being subtracted from the men's pay checks. In this way the members of the crew secured, through their committee, the kind of food they preferred, and if there was any dissatisfaction the responsibility lay with those who themselves had a share in the co-operative mess. The men paid only for what they actually consumed, and the responsibility for the mess arrangements was taken off the company's hands.

This 18-mile Muncie-Alexandria 33,000-volt, three-phase transmission line is carried on Archbold-Brady flexible A-frame towers, set at 380-ft. intervals and securely guyed at distances of 1 mile. The main phase conductors are of No. 1 copper, while the ground wire, which also serves to lash the flexible towers together, is of three-strand, 5/16-in. galvanized Siemens-Martin steel. Three-unit suspension insulators, designed for 66,000-volt use, carry the line conductors.

MOTOR-DRIVEN GEAR FOR HOISTING INTAKE SCREENS.

A ⅓-hp motor is now used to raise the 9-ft. by 22-ft. intake screens which protect the condenser line of the Marion (Ind.) Light & Heating Company's turbine station. Through gearing and a three-strand tackle the motor can raise a screen in three minutes. With the former hand-crank method half an hour of man-killing work was required. Since the job has become an "easy" one, the screens are now cleaned more often and with less grumbling. Frequency of cleaning means, of course, improved turbine efficiency and reduced operating cost. The value of the motor drive has thus proved to be far greater than the simple saving of an attendant's time and effort. The motor hoist has also demonstrated its value when a mass of leaves

Motor-Driven Hoist for Intake Screens.

or drift material suddenly enters the intake, choking the supply. A screen can be lifted in three minutes, whereas formerly twenty minutes at least was required to hoist by hand, during all of which time operation of the plant would have been impaired.

The ⅓-hp motor was used, since it happened to be on hand, the gearing being calculated by Mr. W. F. Thompson, chief engineer, to bring the hoisting duty within the motor rating. The double-geared winding drum connects to the free line of a three-rope block, which is supported from a 25-ft. steel framework built over the screen runs. The upper tackle is attached to a roller trolley, which runs back and forth on an I-beam to bring it directly over any one of the three screens to be lifted. The position of this roller block is controlled by a rope and lever, which can be locked in fixed positions to bring the tackle above either slideway. The intake screens are made up of ⅜-in. wires meshed three to the inch.

STREET-LIGHTING RATES.

By J. R. Cravath.

The method of arriving at street-lighting rates which has often been pursued in this country was once described by a speaker before an electric lighting convention about as follows: Whenever the question of street-lighting rates comes up for settlement, the city council asks for the rates in all the surrounding towns and then asks the electric service company for the lowest rate that any anyone in the council is able to learn about. Every central-station manager who has had to adjust rates with his city council knows how difficult it is to combat arguments of this kind. The council, of course, should be interested in getting the lowest possible rate for the city and is simply pursuing the ordinary methods of business in learning the rates elsewhere and insisting upon the lowest. The method would be all right were it not that in many cases street lighting is taken by companies at less than cost either through ignorance of what the real cost is or for reasons of policy. It is a fact well known among experts that many street-lighting contracts are taken below cost to the service company. It is comparatively seldom that complete investigations are made into the cost of giving street lighting service, and it may be of interest here to mention some of the results of investigations of this kind.

The *Electrical World* published a digest of a number of Massachusetts street-lighting cases coming before the Massachusetts Gas & Electric Light Commission in the past few years in its issue of Sept. 29, 1910. In a number of these cases it is to be noted that the commission authorized a rate of over $100 per arc lamp per year. The respective decisions in these cases were, of course, based on the cost of giving the service plus the depreciation and a fair return on the investment. It should, however, be remembered that fuel costs are high in Massachusetts.

Another notable investigation of the cost of street lighting was that by Mr. B. J. Arnold, of Chicago, consulting engineer, and Arthur Young & Company, public accountants, on the actual cost of street lighting of Chicago. This was made in the year 1908 and covered the cost to the city per lamp per year from 1903 to 1907. This cost was given as $81.46 per lamp. The lamps in this case were the 9.6-amp direct-current open series type and the 7.5-amp alternating-current inclosed series type. The cost at the time the foregoing report was made was stated to be $60.56 per lamp per year. The latter was with a partial supply of energy from the Sanitary District water-power.

In 1907 the Civic League of St. Louis appointed a committee of well-known experts to investigate municipal street lighting for that city. The decisions of this committee were that a municipal plant for street lighting could be built in St. Louis which would supply arc lamps at a yearly cost of $69 per lamp per year.

In 1911 the Wisconsin Railroad Commission rendered a decision in reference to street lighting at Sheboygan, Wis. The commission on complaint investigated the street lighting supplied by the company at that place and went thor-

oughly into the price of this service and the quality. The arc lamps at Sheboygan are 7.5-amp alternating-current inclosed series lamps. After placing a valuation on the property of the company used in street lighting and estimating the cost of service, the commission's conclusions were that, allowing 4.7 per cent depreciation (which the commission considered correct for Sheboygan conditions) and 8 per cent for interest on investment, the cost per arc lamp per year was $68.38.

One of the important events of the past year in connection with street-lighting rates was the decision rendered by the Wisconsin commission in the Waupaca street-lighting case. That case was reviewed at length in these columns and commented upon editorially, and it is unnecessary to go into details here further than to say that the controversy originally arose over the substitution of one kind of lamp for another by the company. The main point at issue was whether the company had defrauded the city by making the substitution. The argument at first hinged mainly on the point of whether the substitution which had been made by the company gave the city an equivalent amount of light. The commission, however, probably went farther than either of the parties to the controversy anticipated when it went to work to investigate the cost of giving street-lighting service in Waupaca and the price received for the service. It evidently proceeded on the theory that if there was to be real justice a controversy over a small difference in candle-power or useful light was useless if the company was not receiving enough for its service in any case. The Waupaca plant is operated most of the day by water-power, with steam for helping at the peak load. There are thirty arc lamps of the inclosed type operating on 7 amp, alternating current. From these a gross revenue of $78.57 per lamp per year was obtained. The expense of supplying this service, including depreciation but including no interest on the investment, was found to be $77.43 per year. In other words, the street-lighting revenues left practically nothing beyond depreciation with which to pay interest on the investment. The commission in its decision gave $97.88 per year as the amount which the city would have to pay per lamp if the street-lighting investment were to yield 8 per cent, the rate of return which the Wisconsin commission usually allows as fair for investments in electrical properties. In view of the rate the city was paying for arc lamps, the commission decided that it had no ground for complaint as to the substitution of one lamp for another where the difference between the lamps is so small.

From the figures which have been quoted from various decisions it is evident that street-lighting rates as they prevail in this country to-day are many of them below the cost of giving the service. Rates for 450-watt arc lamps may be said in general to range all the way from $35 per lamp per year to over $100. In some cases extremely low rates have been made for street lighting on account of competition either present or prospective. There is even a difference of opinion among public utility owners and managers as to whether a company is justified in making a rate below cost for street-lighting service. Some managers have openly expressed themselves as favoring the taking of street-lighting contracts at a figure which would yield no profit. They favor this on the grounds that the higher the street-lighting rates the greater the temptation to build a municipal street-lighting plant, especially as the city frequently has a water-works pumping station to which a street-lighting plant could be added. If the street-lighting plant is added there is the further temptation to go into the commercial side of the business in competition with the central-station company, which is likely to be disastrous to the company because the taxpayers make good all losses on the municipal venture if the municipal rates are too low.

These same managers also point to the value of a municipal pumping contract, which certainly could not be so easily obtained if the city owned a combined water-works and street-lighting plant. Managers who hold this view simply consider any losses on the street-lighting business as a kind of franchise pact and a method of preventing unfair propositions. On the other hand, there are many who maintain that each branch of the service should be entitled to a fair return on the investment. They argue that it is unfair to ask commercial electric-service consumers to pay for losses on the street-lighting business. Public service commissions have generally taken this view when the question has come before them.

The problem of arriving at satisfactory and just street-lighting rates has been complicated by the rapid changes in the art ever since electric street lighting began. The cost of generating electricity has been steadily decreasing, while changes in lamps and appliances for light production have also been frequent, all having an important influence on the cost of production. As a rule not enough attention is given to the cost of street lighting at the time new rates are made. It is too often a one-sided proposition, with the odds in favor sometimes of one side and sometimes of the other. The city council usually has the power to make it very uncomfortable for the company if it does not come to its terms, whether the terms are just or not. On the other hand, the company usually has the practical information as to costs, etc., which sometimes give it an advantage. If these matters were settled on the basis of expert knowledge of costs, street-lighting rates would be much less erratic than they are at the present day.

COST OF OPERATION OF ELECTRIC TRUCKS.

A study of the cost of operation of battery-propelled trucks was carried out by the Waverley Company, Indianapolis, Ind., some time ago, comparisons being made for vehicles of 600-lb., 1500-lb. and 2500-lb. carrying capacity. In these figures it was assumed that the 600-lb. car would travel 40 miles per day, or 12,000 miles per year, and the 1500-lb. and 2500-lb. cars 30 miles per day, or 9000 miles per year. The cost of repairs and renewals given in the table was computed on a ten-year life of the car, and all parts were charged at regular list prices. The cost of batteries and tires was estimated at market price to the customer, although no account has been taken of the labor item of putting them on.

COST OF OPERATION OF ELECTRIC TRUCKS.

	600-lb. Capacity, 40 Miles per Day, 12,000 Miles per Year.	1500-lb. Capacity, 30 Miles per Day, 9000 Miles per Year.	2500-lb. Capacity, 30 Miles per Day, 9000 Miles per Year.
Battery	$190.00	$216.90	$232.00
Tires	120.00	129.06	173.20
Chains, gears, etc	28.37	77.91	85.00
All other parts	22.50	30.00	33.00
Total replacement charges	$360.87	$453.87	$523.20
Electric energy	$176.00	$156.00	$163.00
Garage labor	224.00	224.00	224.00
Driver	750.00	750.00	750.00
Rent, light, heat, etc	72.00	77.00	78.00
Total operating expense	$1222.00	$1207.00	$1215.00
Depreciation	$125.59	$147.91	$172.99
Interest	54.00	61.50	72.00
Fire insurance	18.00	20.50	24.00
Liability insurance	75.00	100.00	100.00
Total fixed charges	$272.59	$329.91	$368.99
Grand total	$1855.46	$1990.78	$2107.19
Per day	6.18	6.63	7.02
Per mile	0.155	0.22	0.234

For the purpose of the calculation, batteries and tires were figured at one year's life, and gears, chains and sprockets at two years (gears, four years; bearings, four

years; driving gears, exposed, one year; driving chain, one year). Electrical energy has been charged for at 4 cents per kw-hr., and rent, light, heat, etc., are estimated at $1 per square foot. The depreciation allowed is based on writing off that part of the vehicle not covered by maintenance in ten years. Interest is computed at 6 per cent of one-half of the purchase price, as the investment is being written off. Under these conditions the conclusions shown in the accompanying table were reached.

COST OF CONCRETING WOODEN POLES AT INDIANAPOLIS.

The Indianapolis Light & Heat Company now makes a practice of concreting all its poles at the ground line to prevent rotting and deterioration, some 1500 poles having been so treated during the last season. New poles are

Fig. 1—Concreted Base of Pole, Indianapolis, Ind.

erected and first allowed to stand a year to make sure that they have become firmly set. With a small spade an opening 4 in. to 5 in. wide is then made all around the pole to a depth of 3 ft. or 4 ft., and this is poured full of concrete, tamped securely and troweled off with an inclined watershed to prevent water from standing about the base. The concrete collar extends a few inches above the ground and gives a neat appearance to the pole base.

A concreting gang of four men with a team can concrete eight to ten poles in this manner in a day. Estimating the cost of keeping such an outfit in the field to be about $15

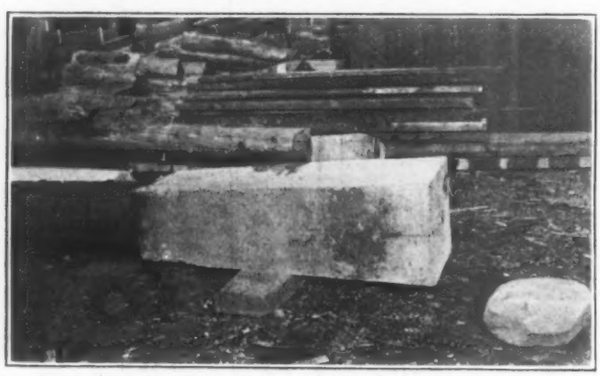


Fig. 2—Experimental Concrete Pole Base.

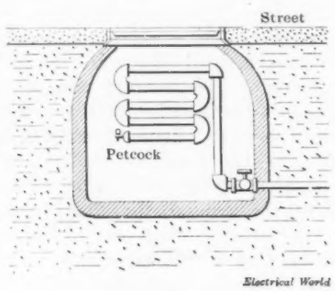
a day, Mr. T. A. Wynne, general superintendent of the Indianapolis company, figures the cost of concreting poles at $1.50 each. Experiments with inclosing the poles in a covering of concrete before erection have also been carried out at the company's pole yard, and poles have been inserted into rectangular concrete butts and braced with heavy steel straps bolted to the wood. Another departure involved the fixing of the pole on a rectangular concrete butt, 20 in. at the base and tapering to 15 in. at the upper end, 5 ft. distant. The connection was made by means of four 2-in. by ⅜-in. straps, crossing and inclosing the concrete butt as in a basket. These earlier experiments have all been discarded, however, in favor of the new plan of concreting at the ground line, the portion to which the major part of the deterioration is confined. Old poles as well as new are receiving this treatment, which is expected to extend their lives by an amount far exceeding the outlay for the concreting work.

STANDS FOR COOKING ON INVERTED ELECTRIC IRONS.

The Marion Light & Heating Company, Marion, Ind., recently distributed among its customers who have electric irons 400 little stands for holding the irons in an inverted position for cooking, heating water, etc. The holders were simply and substantially constructed of ⅜-in. by 1/16-in. iron, securely riveted and painted with aluminum bronze. In lots of 100 they cost 15 cents each, but they were given away by the central station to any customer owning an iron who called and asked for a holder. The holders fit any kind of electric iron and adapt the upturned heating surface for warming water, cooking eggs, boiling coffee, warming baby's milk, etc. With no other device than the electric iron in the house, a fair breakfast can be prepared in a few minutes, the inverted iron making, it is declared, especially fine coffee. The holder is also useful for other household operations, such as steaming velvet, etc. Mr. S. H. Smith, local manager, checked the consumptions of several customers who employed these holders to amplify the uses of their electric irons, and found that those compared had each increased consumption by about 15 cents' worth, so that the little stands paid for themselves the first month.

STEAM-HEATED MANHOLE COVERS FOR CORNER POLICEMEN.

The city of Indianapolis has appropriated $700 to meet the cost of installing steam-heating coils beneath the covers of manholes at twelve downtown crossings for warming the feet of traffic policemen who are required to stand in the street all day long during wintry weather. One such steam-heated manhole is already installed at the corner of Washington and Illinois Streets, but according to the esti-



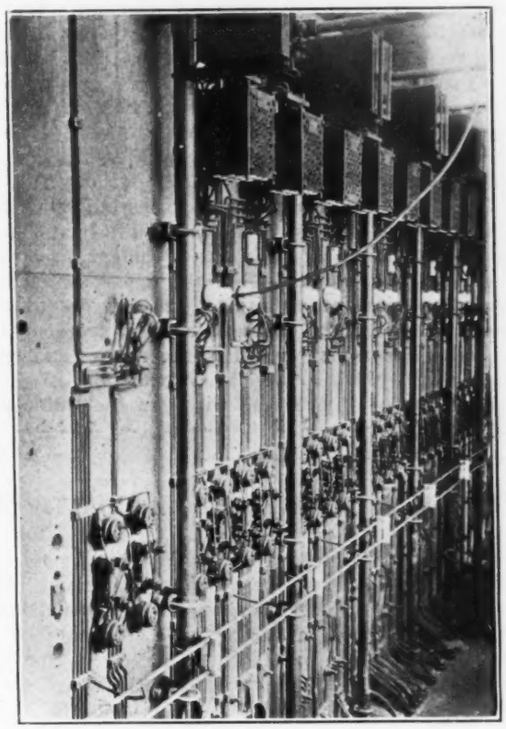
Steam-Heated Manhole Cover.

mates of local central-station engineers the $700 appropriated will not cover the cost of equipping twelve manholes. The steam radiating coil, as shown in the sketch, is provided with a pet cock for freeing it of condensation from time to time. The city will pay for the steam on a radiation basis. Certain policemen have objected to the scheme on the grounds that the heat will cause sore feet.

Wiring and Illumination

CONNECTIONS FOR OBTAINING FEEDER VOLTAGE RECORDS.

The switch structure of the new turbine station of the Laclede Gas Company, St. Louis, is arranged with a double bus, and in the office of the electrical engineer, Mr. William Bradford, are corresponding duplicate recording-instrument

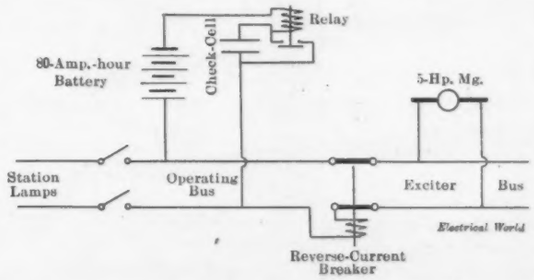


Push-Plug Connections for Voltmeter Records.

panels, each with a Bristol recording voltmeter, General Electric curve-drawing wattmeter and totalizing kw-hr. meters. As only one bus is commonly used in operating, the instruments on the other hand are available for studying individual feeder conditions. For taking voltage curves of each of the ten single-phase feeders Hubbell push sockets have been mounted on the rear of these panels. Suspended from the switchboard braces and running the length of the feeder panels is a conduit line with condulet fittings inclosing similar push sockets opposite the panel sockets. A double-ended prong-plug jumper serves to make the connection between panel and conduit sockets. The conduit line ends in a connection to the regular voltmeter plug, so that a continuous record can be secured of any feeder by plugging from the voltmeter to the corresponding panel socket.

RELAY AUXILIARY CONTACT FOR ALUMINUM CHECK CELL.

The exciter bus is connected to the operating bus in Substation No. 5 of the Union Electric Company's system, St. Louis, through a reverse-power circuit-breaker which opens in case of any reversal due to shutdown of the 5-hp motor-generator set commonly energizing the combined 125-volt bus. Bridged across the operating bus is also an 80-amp storage battery, provided for operating the oil switches in case of interruption of direct-current supply. This battery is arranged with an aluminum-iron check cell containing six aluminum and seven iron plates in a 10 per cent solution of boric acid. The check cell alone operates very satisfactorily in preventing flow of energy in the reverse direction, but was found to introduce about 5 volts drop when passing current normally. This loss, which occasioned local heating, has now been prevented by adding a relay with contacts closing across the check cell. For reverse-



Relay Auxiliary to Aluminum Check Cell in Operating-Battery Circuit.

direction currents the circuit is still open as before. But when the check cell admits current in the normal direction the relay winding is thereby energized, closing the path around the cell. The relay remains closed as long as energy is being drawn from the battery, dropping out again when the current falls below the value necessary to hold up its armature.

USE OF CLAMP INSULATORS WITHOUT TIE-WIRES IN ST. LOUIS.

On the arc circuits and 4400-volt distribution lines of the Union Electric Light & Power Company, St. Louis, nearly 20,000 Fay clamp-type insulators are now in use, the first of these tie-wire-less insulators having been installed about eighteen months ago. In these insulators the tie-wire is replaced by a galvanized bale clamp, similar to those used on some fruit jars, which exerts pressure through a round porcelain pin to clamp the wire down into its slotted seat in the body of the insulator, without injury to the wire or its insulation. This construction was fully described and illustrated in the *Electric World* of May 19,

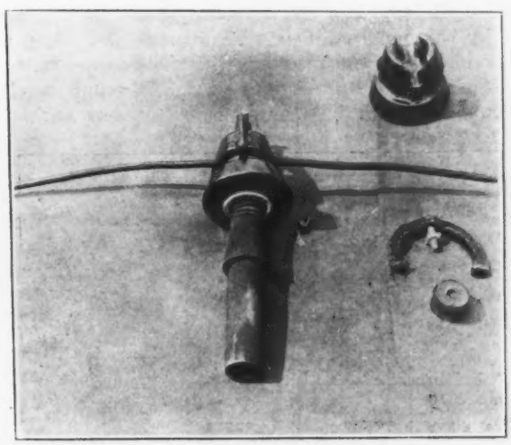


Fig. 1—Clamp Insulator and Parts.

1910. The insulator was devised by a former line superintendent of the St. Louis company, Mr. John L. Fay, now superintendent of distribution for The Milwaukee Electric Railway & Light Company.

The first carload of these insulators used in St. Louis was ordered to equip the city arc circuits, which had been giving much trouble from the corrosion and breaking of

line wires just under the necks of the tie wires. As this peculiar action occurred only on the magnetite or direct-current circuits, the cause appears to have been electrolytic, after being started by slight nicks made in tying up the tie wires. Use of the clamp insulators has, however, completely removed the trouble, according to Mr. K. H. Hansen, electrical engineer for the company. The same construction is now being extended to 4400-volt feeder construction, as shown in the accompanying illustration. Among the advantages secured by the use of the clamp insulators are the superior quickness and permanency with which they can be installed; prevention of injury to line-wire insulation; avoidance of kinking by the lineman in making a wire tie, and elimination of corrosion of the wire at the neck of the tie—all of which lead to ultimate breaking of the wire. If such a broken span drops into the street, it is highly dangerous; if the insulation holds it, the break under the tie-wire is extremely difficult to locate. The position of the wire at the top of the new clamp insulator also introduces greater insulating value for the same size, compared with the usual side-tie insulator. A lineman can also replace insulators or pins when using the clamp device, without "killing" the line, since the insulator has no holding or conducting parts in contact with the wire. In case a pin is broken, the wire can be tied up in an emergency by passing a cord or wire through the clamp arms, without impairing the insulation of the line.

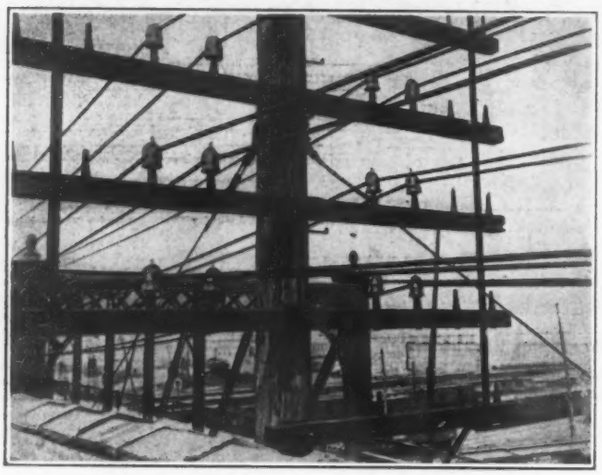


Fig. 2—Clamp Insulators on Wooden Pins.

Purchased in quantities the St. Louis clamp insulators cost, complete with bale and parts, 11 cents each. The equivalent No. 30 porcelain insulator of the ordinary type has recently risen in price to 5.75 cents. A No. 6 tie wire at the present price of copper costs 2 cents to 4 cents. After counting the copper lost and time taken to make the ordinary tie, compared with that for putting up a clamp insulator, there is a difference in cost apparently slightly in favor of the clamp insulation. especially when the advantages of permanence and safety of the clamp construction are considered.

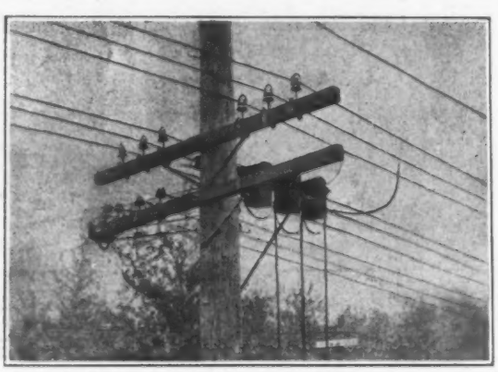


Fig. 3—4400-Volt Feeders Carried on Clamp Insulators and Clamp Pins.

For comparison ten poles were equipped with tie insulators, two primary wires being in easy reach, 28 ft. above the ground. It required one lineman thirty-five minutes to tie in the twenty insulators. The twenty tie wires, weighing 5 lb. 14 oz., cost 4.7 cents per insulator. For clip ends necessary for the grip of pliers 17 oz. was lost, representing a cost of 0.875 cent per insulator. With the insulators themselves costing 5.75 cents, the total cost of material used was thus 11⅓ cents per insulator, excluding the labor of the lineman, which at 50 cents an hour would be about 2 cents per tie. The present cost of the bale-clamp insulators is 11 cents each, complete with galvanized bale and screw, thus showing a saving of a fraction of a cent over the bare material cost of the ordinary tied construction. Since the clamp insulators permit more rapid installation, the labor cost of 2 cents per insulator would be decreased, adding to the slight advantage in price in favor of the clamp devices. But the important factor in the St. Louis situation resulting from the use of these insulators has been the permanency and freedom from broken wires and the saving of future repairs and reconstruction work. Mr. Frederick Worthington is general foreman in charge of overhead wires for the Union Electric Company.

DOWNTOWN STREET-LIGHTING IN BALTIMORE.

The city of Baltimore has the distinction of possessing more than 2½ miles of business streets, comprising nearly fifty blocks, which are illuminated with ornamental luminous-arc lamps. These are of the inverted General Electric type rated at 6.6 amp, and there are at the present time 352 installed. Thirteen more will be connected within a few weeks. The pole, which is shown in detail in Fig. 1, was designed by the Baltimore Art Commission and is an adaptation of the slender supports which the ancients utilized to hold a torch or "flambeau" for the lighting of their streets. The posts, which were cast by the Morris Iron Works, Frederick, Md., and the Lundin Electric & Machine Company, Boston, Mass., are 14.5 ft. high and 1.5 ft. in diameter at the base.

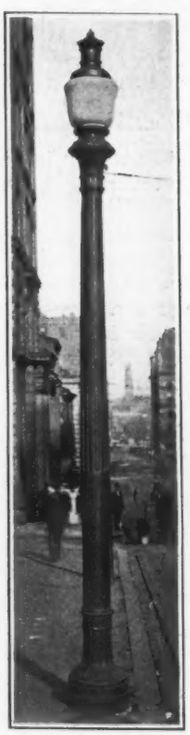
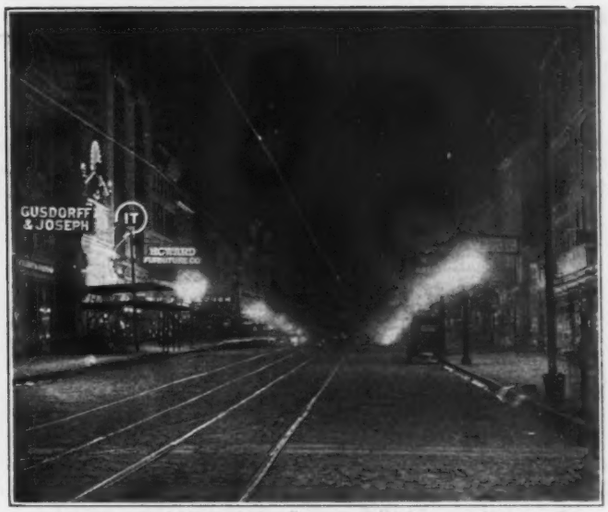


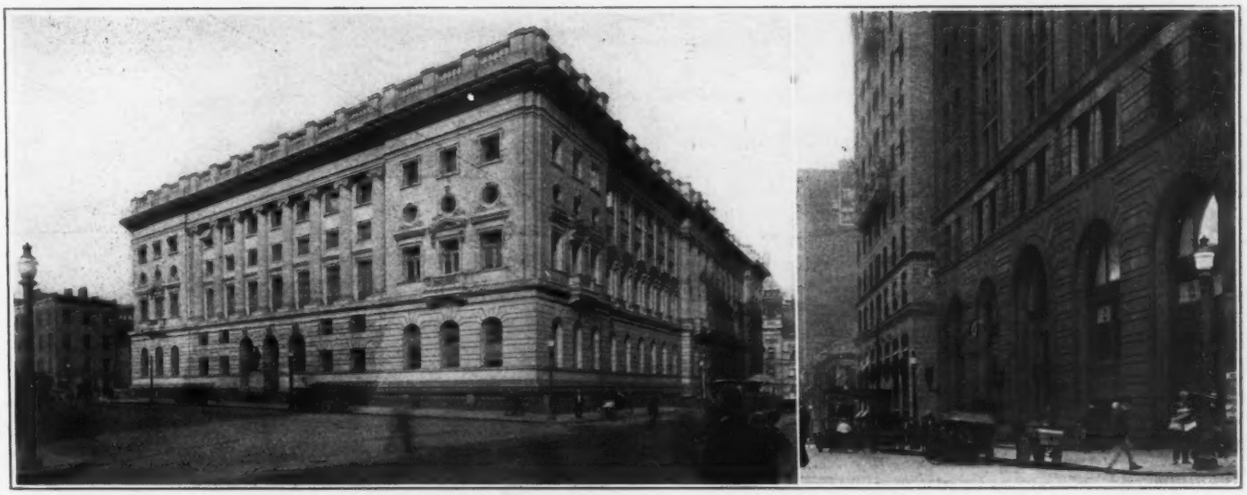
Fig. 1—Baltimore Standard.

The installation was promoted by Mr. G. A. Miller, of Atlanta, Ga., and in the campaign the property owners and merchants, together with the manufacturers' associations and advertising clubs of the city, were conspicuous for their industry. The merchants paid the initial cost of the lamps, the Consolidated Gas, Electric Light & Power Company obtaining this money from the city and the latter collecting from the merchants. The lamps and posts erected represent an investment of approximately $105 each and are spaced from 50 ft. up, according to the amount of money collected from the merchants, which ranged from approximately $2 a front foot to $1.20 a front foot.

The "white way," as it is called, was first placed in



Figs. 2 and 3—Howard Street, Looking North and South from Lexington Street, Baltimore.



Figs. 4 and 5—Arrangement of Luminous-Arc Standards in Business Section of Baltimore.

Figs. 6 and 7—Lexington Street, Looking East and West from Howard Street, Baltimore.

service June 22, 1912, just a week prior to the Democratic convention. As is probably well known, in the inverted-type luminous-arc lamp the arc is formed between an upper electrode of copper and a lower electrode containing the magnetite composition. The lower electrode has a life ranging from 100 hours to 120 hours and has a composition identical with that used in the regular series luminous-arc lamps. The upper electrode is practically non-consuming. In trimming the lamp the ornamental top on the globe is swung to one side and the lower electrode pushed into place. The casing below the globe which protects the mechanism is provided with a door through which access to the mechanism is had. The globe is of special shape, so designed that all shadows are eliminated, and as some of the light is allowed to pass upward adjacent buildings, as well as the streets and sidewalks, are illuminated with a white light. The density of the glassware is such as to make it a secondary source of light, the arc itself being invisible. The lamps, therefore, are free from glare. The five business thoroughfares of Baltimore equipped with this type of lamp are as follows: Baltimore Street from Paca to West Falls Avenue; Eutaw Street from Camden to Franklin; Howard Street from Camden to Center; Charles Street from Baltimore to Center, and Lexington Street from Eutaw to Guilford Avenue.

The city of Baltimore pays the Consolidated Gas, Electric Light & Power Company $99 a year for each of the lamps burning all night and $91 for each of the lamps burning on half-night service. Where the equipment is erected and owned by the city the prices in each case are $89 and $81 respectively.

The accompanying illustrations show views of some of the streets at night and give some idea of the distribution of the light on the building fronts and also on the thoroughfares. From Figs 4 and 5 it is apparent that the lamps are pleasing by day and do not add materially to the obstruction on the sidewalk or to the view, as is the case with the collection of small tungsten lamps used in the tungsten post system that prevails in many cities.

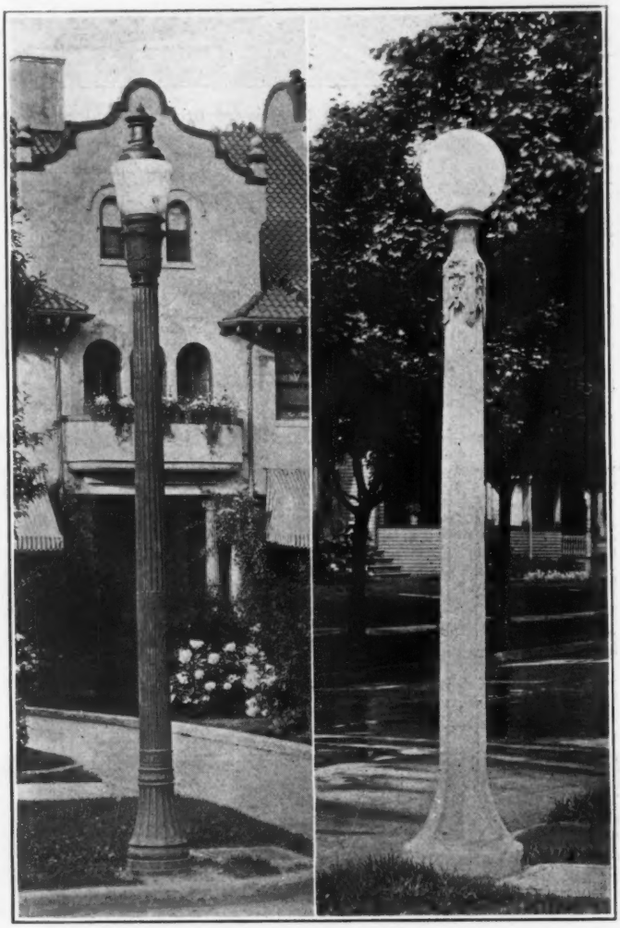
The installation, which is the largest of its kind at present in this country, reflects the tendency now manifesting itself in a number of cities to use a higher candle-power unit supported at a greater height from the street surface on first-class business thoroughfares.

TUNGSTEN LAMPS IN CAR LIGHTING.

An exhaustive trial of the tungsten lamp in street-car lighting service is being made by the Bay State Street Railway Company, of Boston, Mass., under the direction of Mr. E. W. Holst, superintendent of equipment, with the co-operation of Mr. George H. Stickney, of the General Electric Company, Harrison, N. J. The test is being conducted upon two 28-ft. and two 34-ft. semi-convertible cars, and the new lighting units consist of 60-watt clear tungsten wire-type filament lamps equipped with intensive prismatic reflectors and special holders, the lamps being run in two series circuits of five per circuit in order to insure a fair illumination in case one circuit is out of service. Six tungsten lamps are installed in the monitor of each of two cars, the other two cars being equipped with 64-watt carbon lamps. Sixteen of the latter are used in the 28-ft. car and twenty-one in the 34-ft. car. Readings with a Sharp-Millar photometer show that in the 28-ft. cars the average illumination with tungsten lamps is 3.6 ft.-candles and with carbon lamps 2.1 ft.-candles; the 34-ft. car equipped with tungsten lamps has an average of 2.4 ft.-candles against 2.4 ft.-candles with the 34-ft. car and carbon-lamp equipment. In the 28-ft. car the power expenditure is 360 watts for the tungsten-lamp installation compared with 1024 watts for the carbon-lamp equipment; in the 34-ft. cars the power expended is 360 watts for the tungsten equipment compared with 1344 watts for the carbon. The quality of the illumination is greatly improved with the tungsten units. From present indications the company expects to obtain reasonable lamp life in the tungsten installations in spite of the severities of railway service.

IMPROVEMENTS IN STREET LIGHTING IN ROCHESTER, N. Y.

The rapid introduction of the tungsten incandescent lamp for interior lighting has resulted in the education of the general public toward higher standards of illumination. In a remarkably short space of time this desire for more light has also left its impress on public officials, and the central stations throughout the country have been kept busy changing older forms of lamps for improved ones and increasing the illumination in certain other sections. This transition period in public lighting has by no means run its course, and the past four years have witnessed more changes on public highways than the preceding decade.



Figs. 1 and 2—Luminous-Arc and Tungsten Standards in Rochester.

The city of Rochester, N. Y., is one of the many which are struggling to keep pace with the insistent demands for more light on highways, and the engineering department of the Rochester Railway & Light Company has given considerable thought to the problem of street lighting, in its desire to meet the wishes of the city officials and at the same time install units which are not likely to be rapidly super-

seded. Chasteness of design being necessary in any system erected with an eye to permanency, this phase of the public lighting business has had mature consideration. Rochester is a city of homes and beautiful streets, and the Rochester Railway & Light Company, not less than the residents themselves, takes a commendable pride in the appearance of the bring them just under the branches. By this means dark spots are avoided and one can see approaching vehicles or pedestrians with ease. The public press and the citizens have given the company unstinted praise for this system. Part of its cost was borne by local assessment on the abutting property, and the rest was paid for out of the

Figs. 3 and 4—Concrete Tungsten Standards and Cast-Iron Luminous-Arc Posts on Residence Streets of Rochester.

"Flower City's" thoroughfares. The illustrations herewith show some of the more recent street-lighting installations. In Figs. 1 and 4 the new cast-iron standards for supporting the inverted luminous 6.6-amp magnetite-arc lamps are illustrated. There are eighty-six of these on East Avenue, one of the finest residential streets of Rochester, which runs general lighting fund of the city. The posts were built by the Lundin Electric & Machine Company, Boston, and the lamps are of General Electric make.

Figs 2 and 3 show in detail and in vista the new concrete posts with bronze top erected on Warwick Avenue. The bronze top supports a 16-in. rough inside globe in-

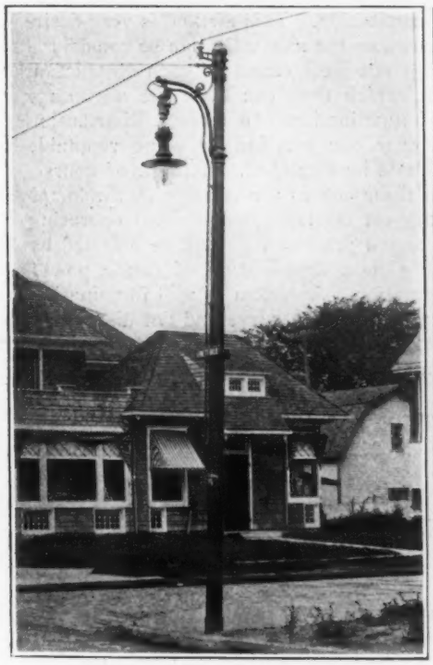


Fig. 5—Combination Arc and Trolley Post.

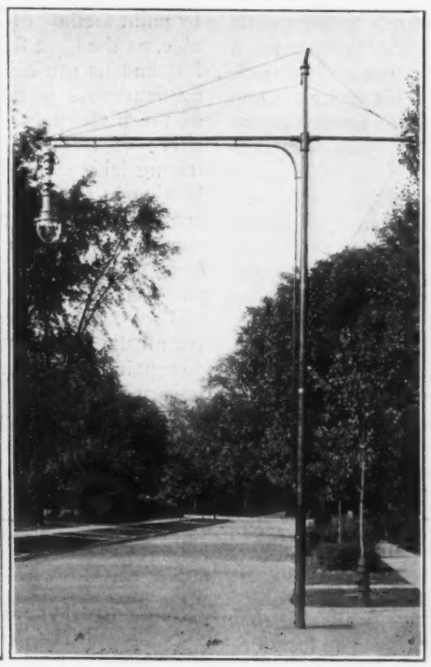


Fig. 6—Mast-Arm Pole for Shaded Streets.

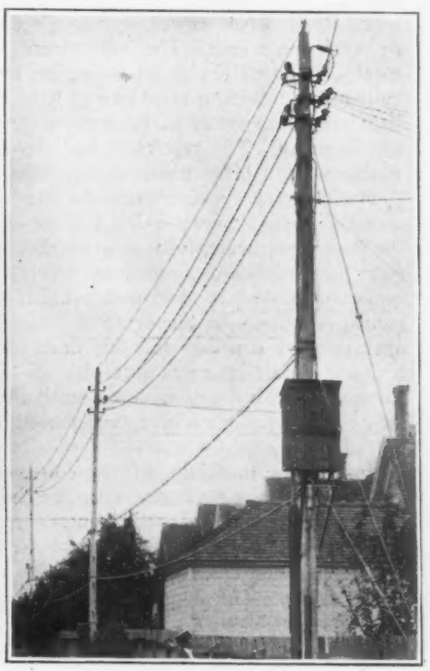


Fig. 7—Back-Yard Distribution System.

from the center of the town to the city line. At either end of the avenue there are two posts placed opposite each other, so as to form a gateway to the system. The rest of the lamps are placed 200 ft. apart and staggered on opposite sides of the street. Although the thoroughfare is lined with beautiful shade trees, the height of the lamps is such as to closing a 60-cp, 4-amp series tungsten lamp. The posts are scrubbed and the panels bush-hammered, so that their appearance is very pleasing, the poles looking as though they had been chiseled out of a piece of granite. On practically all of the residential streets of Rochester there are demands for this type of lighting, and the policy of the company

is to install posts of this design wherever there are existing overhead wires and wooden poles. The additional revenue received for a lamp fed from underground circuits is sufficient to carry the extra investment necessary.

Fig. 5 shows a new design of post on Arnett Boulevard, which serves to support the trolley wires as well as the arc lamp. In the judgment of the engineers of the lighting company, this design is not too ornate and its use has been attended with much satisfaction. A steel post supporting an arc lamp by means of a crane arm 12 ft. long, as used on Dartmouth Street, is shown in Fig. 6. This type of post is very effective on streets where the shade trees are dense.

With its present facilities, the Rochester Railway & Light Company cannot keep up with the demand for rear-lot line construction involving the use of concrete poles. Fig. 7 shows a type of installation of concrete pole for rival telephone circuits, series arc circuits and secondary service feeders. These poles are erected on every other lot, permitting both telephone and electric light wires to run to the four adjoining lots without necessitating the crossing of any property but that served. During the past twelve months the company has installed practically 1500 of these poles.

STEEL-MILL ILLUMINATION.

By B. G. Beck.

In the lighting of steel mills the present tendency is to supply the demand for an increased illumination at all parts of the mill. How to supply this demand efficiently and with the least cost of maintenance or interruption to the service requires a special study for each individual mill building. Not many years have passed since the white-hot iron furnished the light for tapping a furnace, converters the light for manufacturing steel, the soaking pits that for drawing the ingots, and the hot steel sufficient light for rolling. Where sufficient light was not furnished by the metal itself, work was done with the aid of a tallow candle or kerosene torch. The rolls were lighted either by a torch on top of the roll housing or by a natural-gas pipe emitting a flickering streamer of light. This latter method is in use at present in some of the older mills, where natural gas is cheap. The results of the above methods of illumination were a large number of accidents.

The changed requirements are due to the increasing use of mechanical devices which require attention at all times, the increased watchfulness over the safety of employees and the increased production which good illumination makes possible. A steel mill consists of a number of detached buildings or departments, each contributing some operation in turning out the finished product and each building requiring more intensity of light, from the blast furnaces to the finishing mills, until the inspection departments are reached, where well-placed intense light is required.

Most of the buildings will be constructed for the use of overhead traveling cranes with the rolls, tables and mill equipment located near the center of the building. The buildings will range from about 50 ft. to 100 ft. in width and 25 ft. to 60 ft. from the floor line to clearance line of top of crane. The lamps for the general illumination can therefore be located either along the side walls of the building or in the roof above the crane runway. The location along the side walls is undesirable for the following reasons: (1) Glare in eyes of workmen; (2) inefficient distribution due to absorption of light by the black sides of building; (3) constant repairs due to lamp being damaged by crane; (4) small percentage of useful light on the rolls or machinery in the center of the building.

The usual method of locating the lamps in the roof above the crane runway is also objectionable for the reasons next given: (1) Large units required to obtain satisfactory light; (2) inaccessibility for trimming; (3) screening or cutting off of the light by the crane.

The last two objections are the only serious ones against this location. Safety demands that trimmers should not be required to trim the lamps daily from cranes, and the use of the cranes for this purpose interferes with the operation of the mill. In some cases where the safety requirements will not allow lamps to be trimmed from the cranes it has been found necessary to build a steel footwalk the entire length of the building in order to trim the lamps.

The cutting off of the light owing to cranes being directly below the lamp can be obviated by installing on the cranes under the bridge girders lamps of such candle-power as to increase the foot-candles on the floor area covered by the crane. This method proves satisfactory, as in most cases ordinary illumination is all that is required except in case of a breakdown, when the use of the crane becomes necessary and very good light is required. By placing lamps of high candle-power directly under the footwalk the repairs can be made safely under an intense and cheerful light in the shortest possible time. In laying out the general illumination of the buildings the location of lamps with respect to the machinery housed is of first consideration. Where large individual machines require intense light at some particular part of the machine this illumination should not be attempted in the general illumination of the buildings. Where a large number of small machines are located close together it may be advantageous to supply intense general illumination and eliminate the individual lighting of each separate machine.

The lamps to be placed first should be those near rolls, engines, shears or other high obstructions, arranging these lamps so as to throw as little shadow as possible and deliver the maximum intensity where it is most needed. Then it becomes possible to arrange various intermediate lamps so as to give the most satisfactory distribution with the intensity required. Having the distribution curve of the lamp to be used, the best, although the most tedious, is the point by point method of distribution. This method is very desirable, as the light thrown on the side walls can be considered lost and its use brings out the location of each obstruction or dangerous pitfall, which then can have the advantage of the high spots of illumination. In using a distribution curve of this kind only one certified by some reputable testing laboratory should be employed. It must, of course, be kept in mind that these curves are taken with the lamps operating at their highest efficiency under ideal operating conditions, while in actual practice they will be affected by dirt, deposits on the globes, depreciation of candle-power and poor voltage regulation. A system of mill illumination laid out from an ideal distribution curve and not discounted for all the disadvantages inherent in the lamp may prove a disappointment when the lamps are being worked at their lowest efficiency.

The following figures give the intensities which have been found necessary at some mills:

	Foot-Candles.
Roadways	0.1 to 0.75
Yards and loading docks	0.3 to 0.5
Loading in cars	0.75
General illumination in mill buildings	0.4 to 0.6
Warehouses	0.3 to 0.5
Inspection tables	3.5
Shops	0.5 to 1.0
Machine tools	5
Offices	4
Drafting rooms	4 to 6

In the choice of the lamp itself there are available all the types and sizes which are generally used for street or factory lighting. Most of these are sold on recommendations which make them seem well adapted to the steel industry. Although the power problems in steel mills have overshadowed the subject of plant illumination, unreliable

and unsatisfactory illumination has subjected the electrician in charge to more criticism and abuse than any other cause. Therefore a lamp possessing reliability ranks first in importance, while efficiency, maintenance and first cost are minor considerations. The lamp should require no attention during the life of one trim, and this should be true at all times, even when it becomes old and the parts badly worn. The rough-and-ready expedients of poking the lamp with a stick or hitting it with a piece of coke, in order to induce it to fulfil its duties, should not be necessary. But this has been the unavoidable practice with some lamps, to their obvious detriment. There also have been numerous accidents to workmen who have attempted to assist balky lamps. For the safety of the trimmer, the lamp should have a long life and should never require retrimming, adjustment or other attention for at least seven nights of fourteen hours each.

The unreliability of most lamps is due to the atmospheric conditions of the mill. Where wires are found corroded off at the binding posts, difficulties with contacts or moving parts are to be expected and grounded coils become an evil which it is almost impossible to prevent. Under conditions where rotors of induction motors are polished by dust in the air-gap, it is to be expected that lamps will have a hard fight for existence. A lamp with complicated operating mechanism suffers most from the above causes as well as from the damage done by inexperienced workmen. The color should be yellow, since this conforms with the light given off by the hot steel, and wil penetrate the smoke.

On account of the low cost of energy the efficiency, in so far as energy consumption is concerned, has a very small bearing on the cost of operation. When comparing the efficiency of two lamps the ratio of the average foot-candles on the working area of the mill to the watts required should be taken as a basis, since the distribution of light from some lamps may be such as to throw most of the light on the absorbing walls and very little on the floor area.

The voltage regulation in most mills is very poor at times owing to low pressure of steam or gas, excessive station overloads or temporary overloads on feeders. The majority of the lamps will be installed in multiple or series on the standard 250-volt circuit and should burn at any intermediate point between 180 volts and 270 volts without vibrating or damage to lamps. In some buildings only direct current will be available, while in others alternating current only may be used. The lamps where possible should be connected on a feeder direct from the power house, but in some cases this may prove expensive for the small amount of energy necessary for the service, and they should be capable of operating on either alternating or direct current.

All lamps should be made in different sizes so as to adapt themselves to the height of the building and obtain good distribution. The first cost of lamps is always of importance, but maintenance cost is the final consideration of the mill engineer. The effects of fumes and dirt on lamps with moving parts is such as to give them a short life with excessive maintenance cost after the second year. With expert repair men and trimmers this cost can be kept down to some extent, but the chances are that the lamps will receive the least attention of all the apparatus in the mill.

Due consideration should be given to lamp outages, as a short-life lamp will have more outages than long-life lamps. No lamp should be used which will require an expert to repair or maintain it. The simpler the lamp the lower will be the maintenance cost and the less the depreciation. All lamps should be equipped with shades, thus saving a large proportion of the light ordinarily lost on walls, roof or through windows. The large quantity of light which streams through the roof windows of some mills may impress a person on the outside, but it is possible that the workman on the inside would be glad of an increase of light on his work or that the owner of the plant would be pleased to reduce the number of lamps necessary.

Since the introduction of high-candle-power tungsten units, large numbers of these lamps have been installed on account of their reliability. They have shown an average life of over 1500 hours in mill and yard lighting and over 1000 hours average when hung from crane footwalks. The only difficulty experienced with these lamps is in having the old lamps replaced before they depreciate too far in light value. Their life when hung from cranes has been longer than expected, as previously the jar and shaking of the traveling crane had proved very troublesome, but the tungsten units, being light, can be fitted with light supporting springs and give very good service. Where loading of cars is necessary in buildings with runways up to 30 ft., one 500-watt, 4-amp lamp hung from the crane directly over the cars and one over the material to be loaded have furnished excellent light for the workmen.

Keeping the shades or reflectors clean is a matter that must be followed up at all times. The interval at which they will require cleaning depends upon their location. In smoky and dirty locations it has been found necessary to clean shades every week, while in locations with little or no dirt they have furnished satisfactory service for months without being cleaned. For yard lighting, the 500-watt units when mounted with flat cone reflectors on light pipe-framework poles have rendered excellent service and withstood severe storms successfully.

Letter to the Editors

THE KILOVOLT-AMPERE.

To the Editors of the Electrical World:

Sirs:—It seems to have become a fad recently to give the rating of inductive apparatus in kilovolt-amperes instead of in kilowatts as in the past.

It seems to me that machinery used exclusively in handling energy should be rated in energy units and not in terms of dimensions or current-carrying capacity or of the separate components of the energy units. Further, a machine should be rated in terms of its capacity to perform the particular work it is used for most. For instance, a steam shovel is rated in cubic yards of earth per hour and not in terms of coal per hour just because it could be used for that purpose occasionally.

Now, it is objectionable and irregular to have a machine operating at less than unity power-factor, and everything is being done to make this the exception rather than the rule; and while we need a very small quantity of quadrature current in the operation of some important alternating-current apparatus, we can look forward to improvements in apparatus or systems that will eliminate all useless wattless power, and the remaining out-of-phase current will be so insignificant in effect as hardly to justify the introduction of a new unit or its extensive use in preference to the familiar and satisfactory "kw," which is already established in our vocabulary and is, moreover, more easily pronounced and read. The term "kilowatt" is applicable to both alternating-current and direct-current apparatus, and, if left alone, may ultimately be used in rating steam, gas and hydraulic power also.

Chicago, Ill. C. W. Eisenmann.

[The use of the term "kilovolt-ampere" is thoroughly justified by the fact that it, and not "kilowatt," is the universally applicable practical electrical power term. When the power-factor is unity—as is always true with direct-current apparatus, but never absolutely true with alternating-current machinery—it is permissible to rate electrical machinery in kilowatts, but never incorrect to rate it in kilovolt-amperes.—Eds.]

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Drying Motor Windings.—F. C. Aldous.—Where induction motors operate in a very damp atmosphere and the service is not continuous, then, if the period of rest is long enough to allow the motor to cool, moisture will be deposited on the windings. No moisture can, however, be deposited if the windings are kept at a temperature above the surrounding atmosphere. To obtain this result certain European firms use lamps which are installed inside the stator casing and switched on when the motor is not running. The author's method is to use a small auxiliary transformer by means of which a low voltage is switched on to the terminals of the motor when at rest, causing sufficient current to flow through the stator and rotor windings to give the required temperature rise. In the case of a motor with wound rotor and slip-rings, these are short-circuited before the low voltage is switched on. The power consumption is relatively very small, as is seen by the following example: Motor, 1000 hp, three-phase, 5000 volts; normal current, 97 amp per wire; short-circuit current with full voltage, 550 amp per wire. When the motor is at rest and short-circuited the current required to give 20 deg. C. temperature rise is 34 amp per wire, requiring an emf of 350 volts. The power taken from the line is only 4 kw, or 0.5 per cent of the total power taken by the motor. A transformer would be required of 20-kva, 5000-350 volts, or 14:1 ratio, which ratio would vary somewhat according to the size and design of the motor. For drying out purposes a voltage 40 per cent higher would be employed, giving 40 deg. temperature rise. In this case a 40-kva transformer, 10:1 ratio, would be used and the power consumption would be 8 kw.—London *Electrician*, Sept. 13, 1912.

Standardization Rules.—An English translation in abstract of the rules of the German Association of Electrical Engineers for testing and rating electrical machinery and transformers. As has already been noticed in the *Digest*, these regulations refer to the rating of machines on the name-plates, commutation, temperature rise, overload, installation and the standardization of frequencies and voltages.—London *Elec. Review*, Sept. 13, 1912.

Single-Phase Commutator Motors.—R. E. Hellmund and E. W. R. Smith.—In a further instalment of their long illustrated serial on single-phase commutator motors the authors conclude their discussion of types involving useful internal transformer action. They deal with the repulsion motor, the double-fed series motor for speeds above and below synchronism, and motors with armature excitation (Winter-Eichberg motor). In conclusion, they give a brief classification of the fundamental types of single-phase commutator motors.—*Elec. Journal*, September, 1912.

Unipolar Generator.—W. A. Dick.—An illustrated article giving some comments on the construction and transformation of a 2000-kw unipolar direct-current generator.—*Elec. Journal*, September, 1912.

Lamps and Lighting.

Electric Properties of Filaments.—H. Pecheux.—A German translation of his long French paper giving data on the electric properties of a great many different filaments. These refer to the relations between candle-power and voltage, resistance and temperature coefficient of resistance, and the relation between voltage and current. These data are given for carbon filaments, the older metallic filaments and the new drawn-tungsten filament. One of the conclusions of the author is that the drawn-tungsten filament is chemically quite different from the older sintered tungsten filament. Optically the drawn-tungsten filament is similar to the older zirconium-tungsten filament.—*Zeit. f. Beleucht.*, July 30, Aug. 10 and Aug. 20, 1912.

Manufacture of Metallic Filaments.—A note on a recent British patent (No. 18,392, Sept. 5, 1912) of H. Hoge and the "Z" Electric Lamp Manufacturing Company, Ltd. In the continuous squirting of hard paste in the ordinary way straight from the die, the filament is quite flexible and soft and rather putty-like when it reaches the card onto which it is squirted and cannot readily be wound into symmetrical, circular or spiral form. According to this invention, the squirted material, of suitable hardness or with a sufficiently volatile binding agent, is guided as it leaves the press by a conical or cylindrical funnel, so that the filament collects in a refractory tray in symmetrical, circular or spiral form. The filament is heated as it issues from the die, whereby the volatile solvents in the binding agent are driven off and the filament receives sufficient rigidity to fall by its own weight. The coiled filament on the tray is now removed to a baking oven. A finished zigzag filament is obtained by hanging the spiral on a rod of steatite or similar material, which is placed in a vacuum or inert atmosphere while current is passed through the filament. Weights may be hung on the bottom of the loops as required.—London *Elec. Engineering*, Sept. 12, 1912.

Manufacture of Metallic Filaments.—A note on a recent British patent (No. 18,351, Sept. 5, 1912) of E. R. Grote. Instead of the baking and sintering processes in the manufacture of paste filaments being carried out separately, the uncarbonized filament as it leaves the press passes through the center of a high-pressure electric arc in a vacuum or inert or reducing atmosphere, whereby it is brought to a temperature over 2000 deg. C. The filaments are then cut into lengths, placed on a rod or wire in an inert atmosphere and heated, when their ends fall by their own weight. Alternatively the raw metal is extruded and sintered through the arc in the form of thick rods, which may then be drawn out and annealed to form a filament. Also, the metal may be rolled as it leaves the press before passing through the arc.—London *Elec. Eng'ing*, Sept. 12, 1912.

Miners' Safety Lamps.—A note on a British committee report on suitable methods of testing miners' safety lamps. It is recommended that safety lamps should be required to pass a combined test, consisting of mechanical tests, photometric tests and tests in an explosive mixture. The mechanical tests consist of dropping lamps from a height of 6 ft. onto the floor, and dropping weights onto the lamp, along with heating tests of lamp glasses. The minimum candle-power required of flame lamps (in contradistinction to electric lamps) should be 0.30 cp as determined by a pentane standard, and lamps should be required to give this minimum of ten hours. In the case of electric lamps they should be required to give not less than 1.5 cp at the end of ten hours. The mechanical dropping test should be carried out with the battery removed and a dummy of the same weight substituted. Another requirement is that no liquid should escape from the battery when it is turned upside down.—London *Electrician*, Sept. 13, 1912.

Arc Lamps.—Illustrated French translation of two recent German articles on the Schaeffer three-phase arc lamps and on a new single-phase mercury-vapor quartz-tube lamp.—*La Revue Elec.*, Sept. 13, 1912.

Generation, Transmission and Distribution.

Engine Cycle.—A. Leduc.—A paper presented before the French Association for the Advancement of Science on the engine cycle. The author first gives the equations for the efficiency of an engine using steam as operating agent and

of another engine using ether as agent, showing the difference between the cycles in the two cases and discussing adiabatic expansion of vapors accompanied or not by partial condensation.—*La Revue Elec.*, Sept. 13, 1912.

Corona Losses.—K. ZICKLER.—The first part of an article in which the author summarizes the formulas given by former investigators and the results of experimental tests of the corona losses from high-tension overhead wires.—*Elek. u. Masch.* (Vienna), Sept. 15, 1912.

Traction.

Single-Phase Traction.—An illustrated description of the overhead work on the Dessau-Bitterfeld single-phase railway in Germany. The multiple suspension system here used has an auxiliary wire hung by means of movable clamps at a suitable distance below the suspension wire. With this arrangement an approximately vertical, elastic and longitudinal displacement of the conductor is possible, and such an arrangement in conjunction with the automatic tightening device insures both safety and efficiency. —London *Elec. Review*, Sept. 13, 1912.

Budapest.—J. FISCHER DE TOVAROS.—The first part of an article on the electrification of the suburban lines around Budapest, Hungary.—*La Lumière, Elec.*, Sept. 7, 1912.

Installations, Systems and Appliances.

Large High-Voltage Oil Circuit-Breakers.—J. N. MAHONEY.—An illustrated article in which the author reaches the following conclusions: For successful operation a circuit-breaker should have an operating mechanism giving quick and positive action. Tests show that speeds of circuit-breaker operation as low as 0.09 second have been obtained and that an average of 0.3 second to 0.6 second is usual, depending on the method of tripping and the type of circuit-breaker and instantaneous relay. They also show that the voltage disturbance increases with the speed of operation. Isolated generators present, on a given short-circuit, a harder circuit-breaking problem than a like short-circuit from busbars which also carry another load. The nature of this load is also a large factor. While a long time-element serves to limit the shock to the circuit-breaker when opening circuits with large power and low impedance involved, it allows of objectionable drop in voltage and of extensive destruction at the point of short-circuit. On the other hand, it is not only impracticable but undesirable to interrupt a short-circuit during the first cycle when the current is at a maximum. The shock to the generator is not eliminated by any practical speed of operating, and such interruption of the magnetic flux results in serious rise of voltage, unless some other suitable means of absorbing the accumulated energy is provided, a requirement difficult to meet successfully in commercial operation. Moreover, under some conditions, oscillatory surges and resultant voltage rises, due to the combined effect of this accomulated generator energy. and the presence of cables make it difficult for the circuit-breaker to operate satisfactorily. Hence the stored dielectric and magnetic energy in the apparatus and lines of the system that affect a circuit-breaker in a particular situation must be considered in selecting a circuit-breaker of appropriate "ultimate capacity" or circuit-breaking ability. This factor is independent of the insulation and current-conducting characteristics of the circuit-breaker.—*Elec. Journal*, September, 1912.

Electric Heaters.—A note on a recent British patent (No. 16,143, Sept. 5, 1912) of C. O. Bastian. In order to cheapen the construction of "Bastian" heaters a tube of jena glass or other highly vitreous material is substituted for the quartz tube previously used to house the resistance spiral. The jena-glass tubes are made of about ⅛-in. bore and 1/32 in. thick, and the spiral resistor, closely fitting therein, is adapted to absorb between 10 watts and 13 watts per inch length. If the glass is sand-blasted inside and out or otherwise rendered cloudy, the whole tube glows as if red hot.—London *Elec. Engineering*, Sept. 12, 1912.

Electric Operation of Sewing Machines.—An account of successful experiments with electric driving of sewing machines in the residences of seamstresses. The central station paid the whole cost of installation and was recompensed by payments on the instalment plan distributed over several years. The financial returns of the station and the commercial and hygienic advantages for the seamstresses are pointed out.—*Elek. Zeit.*, Sept. 12, 1912.

Wires, Wiring and Conduits.

Cable Conduits.—J. SCHMIDT.—The conclusion of his illustrated paper on modern cable conduit construction. After having discussed conduits of concrete he passes over to iron conduits.—*Elek. Zeit.*, Sept. 12, 1912.

Impregnating Poles.—B. MALENKOVIC.—An article on impregnating wooden poles with zinc chloride, sodium fluoride solutions, and with a "bellite."—*Elek. u. Masch.* (Vienna), Sept. 15, 1912.

Electrophysics and Magnetism.

Photo-Electric Effect.—A. L. HUGHES.—An illustrated article on the photo-electric effect of some compounds, especially in $ZnCl_2$, P_2O_5, PbI_2, HgI, HgI_2, HgCl, $HgCl_2$, $FeCl_3$, SbI_3 $BiCl_3$, the oxides of Ba and Cu, and anthracene. Dry $ZnCl_2$ and P_2O_5 show no photo-electric effect. There is practically no effect for $FeCl_3$, and only a very small one for PbI_2, after exposure to ultra-violet light. The other halogen salts show well-marked effects after exposure to ultra-violet light. The initial effect is either zero or very small for the halogen salts, but after exposure increases in many cases to a large value. (SbI_3 is an exception to this rule.) The explanation suggested is that the salts themselves are not photo-electric with wave-lengths longer than λ 1949, but that the light first of all decomposes the surface and then acts on the metallic element in the ordinary way. The more stable the salt, the less is this effect. The photo-electric effect in anthracene is produced entirely by wave-lengths shorter than 2002 μ. The maximum emission velocity corresponding to 1849 μ is 0.87 volt. $ZnCl_2$ and P_2O_5 have no photo-electric effect when dry, but after contact with moist air they show a distinct effect. This effect cannot be accounted for by the photo-electric activity of water, which, if it exists, is much too small.—*Phil. Mag.*, September, 1912.

Alpha Rays of Polonium.—V. E. POUND.—An account of an investigation in which the secondary radiation excited by the alpha rays of polonium in carbon was found to increase in intensity as the temperature of the carbon was lowered from room temperature to that of liquid air. This increase in the secondary radiation from carbon as its temperature was lowered has been shown to be due to an increase in the amount of gas occluded in the surface of the carbon. Since it has been shown that gases occluded in such substances as carbon contribute to the secondary radiation excited at the surface of these substances by alpha rays, it follows that the procedure adopted in this investigation constitutes a new method of studying the phenomena of occlusion. The results of the experiments described in this paper also go to show that with a metal like brass the amount of a gas retained in its surface when it is placed in a vacuum is less at the temperature of liquid air than at ordinary room temperature.—*Phil. Mag.*, September, 1912.

Discharge from an Electrified Point.—A. M. TYNDALL.—An account of an investigation of the spread of the discharge from an electrified point. A method of comparing the specific velocity of ions under different physical conditions, from the distribution of current over the plate in point-plate discharge, was tested for the ions in air. The observed ratio of velocities of these ions at atmospheric pressure agrees with the accepted value. Owing, however, to the breakdown of assumptions as to the nature of the discharge the method cannot be applied to lower pressures, and for the same reason has probably only a restricted application in general.—*Phil. Mag.*, September, 1912.

An Electromagnetic Effect.—S. R. Williams.—A discussion of some experiments made in 1895 by Bowden on the behavior of a column of mercury in a magnetic field when carrying an electrical current. The author explains the magnetism of this effect by assuming that a liquid conductor represents a bundle of conducting filaments. The current flowing through these in a magnetic field will behave as it does in a flexible conductor in a magnetic field. In any case, whether we are dealing with conduction through gases, liquids or solids, the effect obtained is due to the reaction between the magnetic field produced by the moving charges and the field in which the charge is moving. The author uses his results to suggest a simple and accurate method for measuring magnetic field strengths.—*Amer. Jour. of Science,* September, 1912.

Units, Measurements and Instruments.

Magnetic Shunt Vibration Galvanometer.—H. Tinsley.—After briefly discussing the difficulty of making a vibration galvanometer for low frequencies, a Kelvin type of vibration galvanometer with magnetic shunt is described. This type is convenient and robust, has stability of zero and is easily tuned. Some details are given of the results obtained. In Figs. 1 and 2 *SP* is the suspension piece carrying the moving system, *MC* the magnetizing coil through which the alternating current flows to actuate the needle, *PM* is the permanent magnet giving directive force to the moving system, and *MS* is a magnetic shunt which traverses the two limbs of the permanent magnet by turning the screw *TS*. The motion of this magnetic shunt increases or decreases the amount of magnetism acting on the suspended needle and forms a very ready and robust method of bringing it into resonance with the frequency of the alternating current being measured. The pole pieces *NS* are slightly adjustable in order to further diminish the controlling force. By this means the scale of the galvanometer for different frequencies can be opened out and made to give as much as 2 in. for a difference in tuning of 10 cycles in the neighborhood of 50 per cent.—London *Electrician,* Sept. 13, 1912.

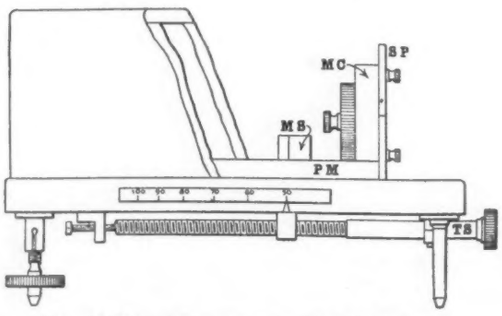


Fig. 1—Side Elevation of a Magnetic-Shunt Vibration Galvanometer.

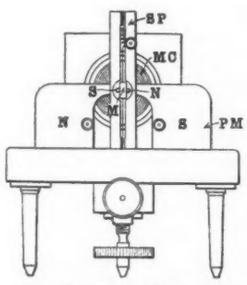


Fig. 2—Front Elevation of Magnetic-Shunt Vibration Galvanometer.

Bomb Calorimeter.—R. S. Whipple.—A British Association paper on a new bomb calorimeter due to C. Féry. The bomb of the usual calorimeter is somewhat heavy and necessitates a considerable weight of water, so that the temperature rise is only about 2 deg. C., requiring careful observation. In the present apparatus the bomb is much lighter and no water is used, the rise of temperature being observed thermo-electrically. The bomb *A* (Fig. 3), in which combustion takes place, is a cast-iron vessel weighing about 1 kg (2.2 lb.) and having a holding capacity of about 250 cu. cm. It is supported by two constantan disks, *K* and *K'*, of about 1 mm thickness, the disks being soldered both to the bomb and to the brass surrounding vessel *B*. The cover of the bomb is held in position by means of the collar (shown in section), which fits over the top of the bomb in a somewhat similar manner to that in which a breech fits a modern gun. The coal to be tested is placed on the small tray *C* and is ignited by means of a piece of cotton resting on the nickel-chromium heating wire connecting the two terminals in the cover, the latter being connected to the battery *P*. Oxygen at 200 lb. pressure is introduced into the bomb through the needle-valve *p*. Thermocouples made of constantan (an alloy of copper and nickel) and iron are largely employed commercially, giving an emf of about 40 micro-volts per degree Centigrade. In this instrument the constantan disks and the bomb act as a thermocouple, the iron of the bomb forming the hot junction, the brass surrounding vessel the cold one. The emf thus generated is measured by the voltmeter *V*.—London *Electrician,* Sept. 12, 1912.

Mercury Rectifier.—A note on a recent British patent (No. 17,286, Aug. 8, 1912) of H. S. Hatfield. On account of the liability of glass to crack by heat, a quartz or similar heat-resisting body is fixed within a glass tube which contains an indifferent gas. Two poles of the circuit may be connected to two masses of mercury, one being contained in a quartz tube immersed in the other. In the make position the mercury is continuous. By suitably causing the level of the mercury in one or both to sink the break takes place at the edge of the quartz tube.—London *Elec. Eng'ing,* Aug. 15, 1912.

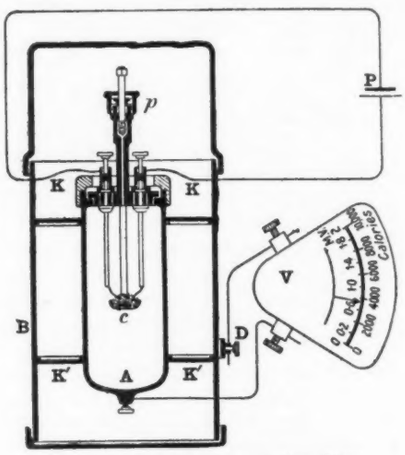


Fig. 3—Cross-Section of the Féry Bomb Calorimeter.

Book Review

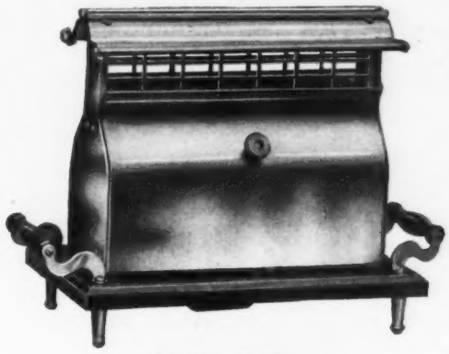
Structural Design. By Prof. Horace R. Thayer. New York: D. Van Nostrand Company. 213 pages, numerous illustrations. Price, $2.

An elementary handbook on simple wood and steel roofs and bridges and their members, intended to supplement future books on the design of simple and advanced structures. The character is largely descriptive, explaining conditions, practice and requirements in a manner calculated to aid the designer in understanding the reasons for different methods of procedure and also the application and modification of the ordinary methods of designing. It therefore supplements the technical data already easily available from many sources and is especially valuable for the beginner or the theoretical student without much practical training. The principal plant methods and operations for the fabrication of structural steel are illustrated sufficiently to indicate the manner in which ordinary structures are built. Many of the principal points of design and computation for steel strusses are explained and illustrated and some examples are worked out. The preparation of bills of material and members, checking and inspection are outlined and a brief analysis is made of the reasons for some important bridge failures.

New Apparatus and Appliances

RADIANT ELECTRICAL TOASTER.

A radiant toaster, stated to possess many improvements in design and advantages in operation, has recently been placed on the market by the Helion Electric Company, of

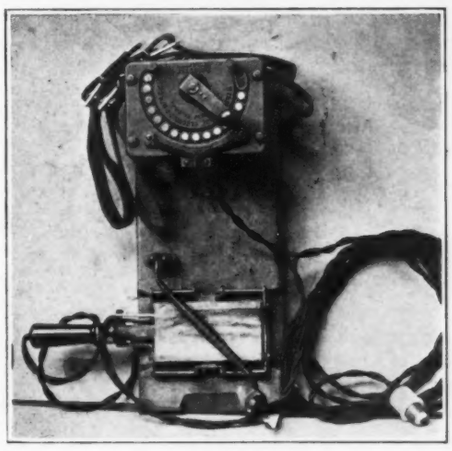


Electric Toaster.

Newark, N. J. It is equipped with four straight "Helion" resistor units, which are brought to an almost white glow when the current is passed through them, making the device very cheerful in appearance. The toaster has a rack on top for holding finished toast and two hinged doors at the sides to keep the toast in close proximity to the heating units. It is equipped with a cast-metal base and 6-ft. silk cord with plug, and the legs, made of insulating material, are sufficiently long to prevent the heat from scorching the table. It is claimed that the "Helion" resistor material will withstand a temperature of 3100 deg. Fahr. without any change in its physical, chemical or electrical characteristics and that it cannot be injured by dirt, wind or water.

ELECTRIC VULCANIZER.

Any article or piece of apparatus which can be used for lessening the repair bill of automobiles is of considerable



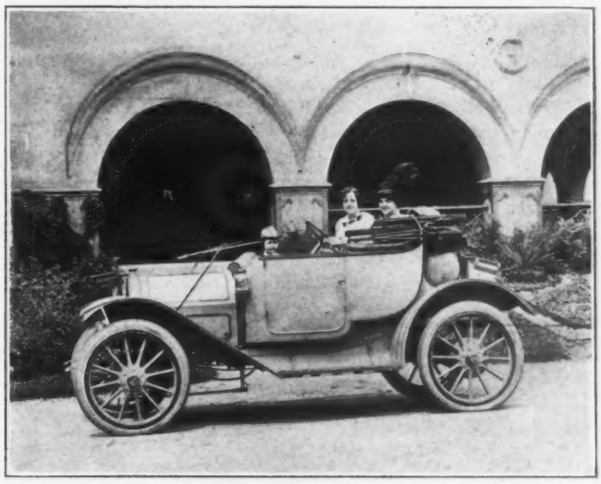
Electric Vulcanizer Outfit.

advantage to both manufacturers and prospective buyers of motor vehicles. Such a device is an electric vulcanizer which has recently been placed on the market by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. The vulcanizer may be used for repairing both the cover or shoe and the inner tube of the tire and is for that purpose provided with one concave surface and one flat surface. The concave surface is attached to the shoe while on the wheel, the process being completed even without detaching the tire. In repairing the inner tube the patch is placed on the tire and then clamped to the flat surface of the vulcanizer. The heating element consists of a metal ribbon embedded in mica and hermetically sealed in the vulcanizer casing. This construction keeps the heater free from contact with the air, thus preventing oxidation. The vulcanizer should be brought up to a temperature of 275 deg. before applying and this temperature must be maintained throughout the process. The temperature is controlled by a fifteen-step rheostat attached to a clamping board, and the operator can observe the temperature on a thermometer also attached to the same board. Connection can be made to any direct-current or alternating-current circuit of from 100 volts to 125 volts. The complete outfit is compact and can be placed anywhere in a garage.

ELECTRIC RUNABOUT.

The Waverley Company, of Indianapolis, has originated a new design of electric runabout known as the sheltered roadster, designed after the fashion of the gas-car roadster, but with several improvements in body design.

The manufacturer states that the chief feature of originality in this roadster is the combined landau and open-roadster top effect. With this particular top it is only



Electric Runabout.

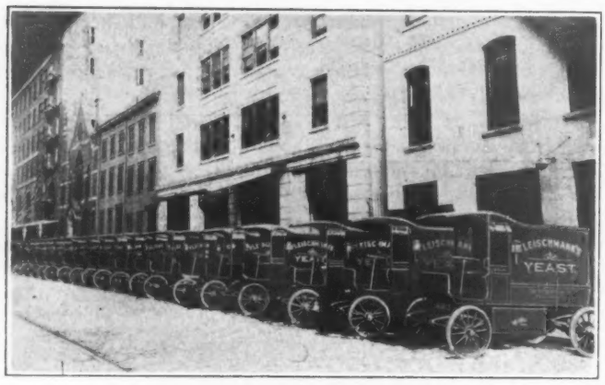
the work of a moment to convert from one to the other, adapting the car for every season.

This roadster accommodates three persons, for an extra folding seat is comfortably arranged on the right hand in front. The body is long, deep and wide and the back of the seat is unusually high. Full elliptic springs are provided in order to make the car easy riding. The manufacturer claims that it has a speed of more than 25 miles an hour and a greater mileage than any other electric closed car known.

ELECTRICAL VEHICLES FOR YEAST DELIVERY.

Competitive tests to determine whether the gasoline or the electric vehicle is better suited for the delivery of its product are being made by the Fleischmann Yeast Company, of New York, in the various localities which it serves. All of its horse delivery wagons have been supplanted by either

electric or gasoline cars. These tests have been going on for about six months and will be continued for at least six months more, the company feeling that a year is the shortest time in which the respective merits of the different types of commercial vehicle can be demonstrated. It now has the twenty 600-lb. Waverley electric delivery wagons shown in the accompanying illustration in service in New York and



Electric Delivery Wagon.

has placed an order for ten more Waverley electrics of the same capacity, which will be placed in operation in Washington, D. C., by the first of next year. One 750-lb. Walker and one 5-ton General Vehicle are also being tested by the company.

A 1913 MODEL ELECTRIC BROUGHAM.

Dignity and attractiveness characterize the "1913 model" of electric brougham made by the Woods Motor Vehicle Company, of Chicago, and illustrated herewith. The car is characterized by greater roominess and width of seat than former models. The car seats four persons. It has a wheelbase of 92 in., being provided with forty cells of 11-plate battery of a new style which is said not to require washing. The motor is designed especially for hill climbing, and there is a powerful motor brake, operated by the controller handle, as well as large internal-expanding rear-

Electric Brougham.

hub brakes operated by a foot lever. Five running speeds, ranging from 4 miles to 20 miles an hour, are provided. Thirty-two-inch tires are used in front and 34-in. for the rear wheels. The chassis has a drop frame and is interchangeable with victoria or roadster body. A view of one of the new model broughams built by the Woods Motor Vehicle Company is reproduced herewith.

EXHIBITS AT THE BOSTON ELECTRICAL SHOW

A news account is published elsewhere in this issue of the opening of the electrical show which is being held in the Mechanics' Building, Boston, Mass. We append herewith brief notes on some of the most interesting exhibits.

Adams Gas Light Company, Adams, Mass., is keeping open house for the Massachusetts Lighting Companies at the show.

Alberger Pump & Condenser Company, New York, is showing centrifugal pumps under test with Venturi meter measurements, motor-driven turbine pumps and photographs.

Albert & J. M. Anderson Manufacturing Company, Boston, is showing a 20,000-amp circuit-breaker for 250-volt service, a motor-driven end-cell switch, time switches and trolley-line material.

Dr. F. S. Alden, Boston, is exhibiting "Cryptofil" chains, concealing lead wires for electric lighting in the links.

The American Brass Company, Waterbury, Conn., is showing a new line of die-pressed metals, for supplying metal pieces of highest quality for service where the defects of cast stock would be intolerable, extruded products, also samples of transmission cable used in recent important work on the Mississippi River at Keokuk, Panama Canal conductor rail for lock service, special intricate sections produced by the extension process, insulated wire and cable. "Benedict nickel white metal" is also shown.

American Electric Tool Company, West Newton, Mass., is showing "Carver" portable electric tools, including drills and grinders.

American Sign Company of New England, Portland, Me., is showing fixed and flashing signs and flashers. The company uses one 25-watt lamp per square foot of sign area.

American Sugar Refining Company, Boston, is showing a motor-operated model pneumatic scaling machine.

American Technical Society, Boston, is showing cyclopedias of electrical and mechanical engineering, architecture and law.

American Woodworking Machinery Company, Boston, is showing a line of motor-driven tools for the pattern shop and wood mill.

Anderson Electric Car Company, Detroit, Mich., exhibits a new five-passenger car, all seats forward, speed 25 m.p.h.; a two-passenger gentleman's roadster, a 1000-lb. truck capable of a speed of 15 m.p.h., and a four-seated brougham.

Apple Products Company, Suffern, N. Y., is operating a cider mill of 50 gal. per hour capacity by a 1-hp motor.

Ashton Valve Company, Boston, is showing electric-lighted steam gages.

Atlantic Vehicle Company, New York, shows a 5-ton chassis with 40-in. rear wheels, irreversible steering gear and improved thin spring suspension.

Automatic Refrigerating Company, Hartford, Conn., is showing a ⅜-hp refrigerating plant for domestic service, its capacity being 250 lb. in 24 hours. The temperature regulation is within 2 deg. Fahr. A larger outfit for butcher service is also in the company's booth.

Automatic Transportation Company, Buffalo, N. Y., is showing a 2000-lb. storage-battery industrial truck, with buffer to open swinging doors, and a coal truck with detachable hopper.

Automobile Journal Publishing Company, Pawtucket, R. I., is distributing the *Motor Truck*.

S. R. Bailey & Company, Boston, shows three roadsters with the usual Edison battery equipment, including a patrol car with ladder and lamp fitting box for twenty-four-hour central-station service.

WALTER BAKER COMPANY, Boston, is showing electrically heated chocolate urns, a miniature mill and a full-sized wrapping machine.

BAKER MOTOR VEHICLE COMPANY, A. F. Neale, Boston, shows a model brougham, seating five passengers facing forward and equipped with a G. E. 1913 design vehicle motor of increased capacity, wheel steering and control, arm rests, silk curtains and improved grease cups.

BAKER MOTOR VEHICLE COMPANY, F. N. Phelps, Boston, commercial exhibit, shows eight trucks and wagons of 500-lb. to 4000-lb. rating, including a new combination police patrol and electric ambulance for the town of Swampscott, Mass., with plate-glass furnishings and speaking-tube service, capacity two patients. A chassis showing the motor drive in operation is in service at the booths.

BERGER MANUFACTURING COMPANY, Canton, Ohio, is displaying three sizes of motor-driven "Tuec" vacuum cleaners for domestic and factory service.

BLAKE & KNOWLES STEAM PUMP WORKS, Boston, exhibits a Dean electrically operated sand riddle, triplex pump, open feed-water heater, single pump with positive starting feature and a garage pump.

BOSTON ICE CREAM COMPANY, Boston, is operating a complete motor-driven ice-cream plant with direct-current motors.

BOSTON INSULATED WIRE & CABLE COMPANY, Boston, is exhibiting samples of its regular products, and is showing two motor-driven braiding machines.

BOSTON LAST COMPANY, Boston, is showing the application of electric heat to every heating process in the shoemaking industry.

BOSTON LIGHTNING ROD COMPANY, Boston, exhibits its regular products with miniature test installations.

BROWN-HOWLAND COMPANY, Boston, is exhibiting loose-leaf and office economy devices, including a mailometer driven by a vertical motor, and a new envelope sealing machine belt-driven by a 1/20-hp motor, the capacity being 300 per minute.

BUFFALO ELECTRIC VEHICLE COMPANY, Buffalo, N. Y., is showing two model "30" five-seated limousines, one equipment having wire wheels, and a model "29" roadster. Long wheelbase, wheel steering and steel motors are used.

BUREAU OF STANDARDS, Washington, D. C., is showing testing instruments, copies of electrical standards, publications and photographs of the Washington laboratory, with samples of rails from recent wrecks.

A. S. CAMPBELL, Boston, is showing electric marine fittings, binnacle and search-lamps, cabin fixtures and battery boxes.

CAMPBELL ELECTRIC COMPANY, Lynn, Mass., is showing a full line of electro-medical apparatus, time switches, flashers and low-voltage transformers.

WILLIAM CARTER COMPANY, Needham, Mass., is demonstrating the use of knitting machines of the motor-driven type and also crocheting machines for underwear manufacture.

CENTRAL STATIONS.—Maine Electric Association, Lynn Gas & Electric Company, Massachusetts Lighting Companies, Worcester Electric Light Company, Tenney Companies, United Electric Light Company of Springfield, Mass.; Cambridge Electric Light Company, Lowell Electric Light Corporation, Edison Electric Illuminating Company of Brockton, Mass.; Turners Falls Power Company, C. D. Parker & Company, Boston, and the Narragansett Electric Lighting Company, of Providence, R. I., are maintaining visitors' headquarters at the show, displaying photographs of plants and the last named a model electrically driven factory.

THE CENTRAL STATION, New York, is keeping open house and exhibiting the "Standard Wiring Handbook."

CENTURY ELECTRIC CAR COMPANY, Detroit, Mich., has established headquarters at the show.

CHASE & SANBORN, Boston, are showing an electric coffee weigher operating to 1/100 oz., a motor-driven labeling machine and a heading machine.

CLARK & MILLS ELECTRIC COMPANY, Boston, is demonstrating "Vacuna" vacuum cleaners.

WM. H. COLGAN, West Newton, Mass., is exhibiting "Rex" junction box covers, stage receptacles and special fixtures.

W. H. COLGAN COMPANY, West Newton, Mass., is showing a one-way charging plug and "Rex" junction boxes.

COLUMBUS BUGGY COMPANY, Columbus, Ohio, is showing four coupés and roadsters embodying increased battery equipment, larger motors, a full floating type of rear axle and two internal expanding brakes on the rear hub operated by foot-levers. One of the latter equalizes with the contracting brake on the drive shaft instead of being operated by the controller. A double torsion bar is used and another

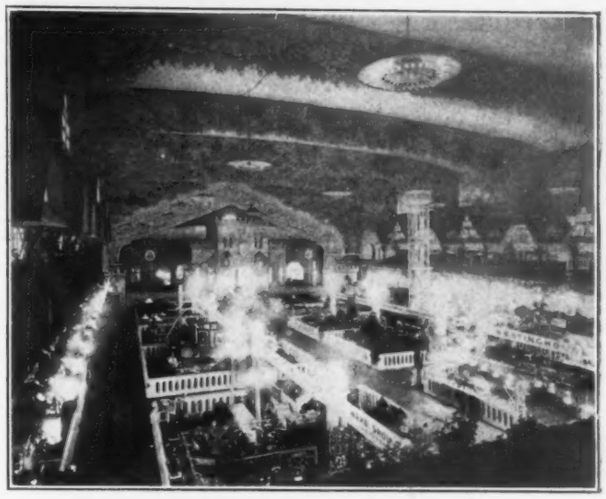


Fig. 1—General View of Grand Hall.

improvement is the use of a 55-in. three-quarter elliptic spring suspension.

A. L. COLWELL, Boston, is showing electric massage and hair-drying outfits.

CONDIT ELECTRICAL MANUFACTURING COMPANY, Boston, is showing a full exhibit of circuit-breaking and remote-control devices, including a new line of remote-control electrically operated switches, Chase-Shawmut fuses and time-limit relays.

S. B. CONDIT, JR., Boston, is exhibiting a variety of interior wiring material, flexible conduit, "Alphaduct" and Thomas & Betts fittings.

CRANDALL PACKING COMPANY, Boston, features packing and boiler compounds.

CROCKER-WHEELER COMPANY, Ampere, N. J., is exhibiting motors, generators, armature coils, punchings and "Remek" transformers. A new line of electric fans of fixed and oscillating type, including a new 9-in. fan, is shown.

DALTON ADDING MACHINE COMPANY, Poplar Bluff, Mo., is displaying several sizes of motor and hand-operated comptometers.

C. J. DARLING, Oak Bluffs, Mass., is showing motor-driven pop-corn and candy machinery.

DENNEN & HALL, Boston, have an exhibit of "Easy" motor-driven washers.

DRAEGER OXYGEN APPARATUS COMPANY, Pittsburgh, Pa., is showing the "pulmotor," with daily demonstration.

JOHN DUGDILL & COMPANY, Failsworth, Manchester, Eng-

land, are displaying a full line of patent focusing movable electric fixtures with universal adjustments.

Duntley Products Company, Erie, Pa., is showing four sizes of motor-driven vacuum cleaners.

Economical Electric Lamp Company, New York, is showing "Hylo" and "Mazda" lamps.

Edison Electric Illuminating Company of Boston is displaying a 12-ft. by 50-ft. map of the company's transmission lines and the principal centers of distribution in its 600-sq. mile territory. A branch appliance exchange is also in service, and the company is maintaining a branch sales organization and service bureau at the show. The laboratory department has an elaborate exhibit of testing instruments with photographs illustrating the principal service tests regularly conducted on the system. A large display of energy-consuming devices and machinery for home and farm service is also shown.

Edison Storage Battery Company, Orange, N. J., is showing materials and methods used in the construction of its plates and application of electrolyte, a new alternating-current rectifier, a voltage regulator and a house-lighting outfit.

Thomas A. Edison, Orange, N. J., is exhibiting primary batteries, alternating-current rectifiers, new Edison phonographs and kinetoscopes for home use.

Electrical Merchandise and *Electrical Progress,* the Rae Company, New York, are maintaining headquarters at the show.

Electrical Review and Western Electrician, Chicago, is maintaining business quarters at the show and distributing current copies.

Electric Speedometer Company, Boston, exhibits an aeroplane tachometer with gage attached to wrist strap, and also speed indicators of the magneto type for electric car service.

Electric Vehicle Club of Boston is co-operating in maintaining a model commercial garage in the basement of the Mechanics' Building.

Electrical Testing Laboratories, New York, exhibit photometric, thermometric, vacuum, coal and paper testing equipment, characteristics of the arc lamp, and a 2700-cp, 3000-watt incandescent lamp, understood to be the largest ever built. Photographs of the work of the organization are also shown.

Electrical World, New York, is exhibiting periodicals and books from the presses of the McGraw Publishing Company, bound volumes of the *Electrical World* for the past fifteen years, photographs of the home offices and a map showing the distribution of circulation in the United States.

Electric Blower Company, Boston, is showing fans for forge and ventilation service.

Electric Development Association, Boston, is conducting a co-operative popular campaign for the larger utilization of electricity in domestic and industrial service.

Electric Show News, a daily published at the Mechanics' Building, has a complete printing-plant exhibit with electric driving.

Electric Storage Battery Company, Philadelphia, is displaying photographs and maps showing notable installations, district office and service organization, plates and cells of various types and an "H-77 Exide" cell of the type used by the Boston Edison Company, besides battery maintenance equipment.

Geo. H. Ellis Company, Boston, is operating a complete job-printing plant by electric power, each machine having individual motor drive.

Ensign Manufacturing Company, Boston, is showing motor-driven calculating machines of various sizes.

L. Erickson Electric Company, Boston, is showing fixtures for display case work, ceiling service and reflector equipment.

Fancleve Specialty Company, Jamaica Plain, Mass., is exhibiting interior wiring fittings, including a new design of elbows for attachment to molding.

Federal Sign System, Chicago, is displaying sockets, heating appliances, coffee grinders, signs, vacuum cleaners, chandeliers and reflectors.

Flanders Manufacturing Company, Pontiac, Mich., is showing a colonial passenger car of the company's standard design, a four-passenger car and a duplicate of the car entered by the company in the late Glidden tour.

Flexlume Electric Sign Company, Buffalo, N. Y., is showing an "Oplex" glass sign of new design and flashers.

General Acoustic Company, Jamaica, N. Y., is showing dictographs and a new acousticon with six rheostatic adjustments in the transmitter circuit for sound regulation.

General Baking Company, Boston, is exhibiting an electrically driven bakery, including a 1-lb. bread mixer, weigher, automatic proofer, molding and conveying machinery.

General Electric Company, Schenectady, N. Y., has a striking display of motor-driven machine tools designed, built and operated by students in the factory, apprentice course, safety features applying to tool service, and a bank of motors equipped with friction brakes, controllers and testing instruments. For the first time at any exhibition the manufacture of miniature carbon incandescent lamps is being conducted in every detail before the eyes of visitors, nine young women being employed in this work. An exhibit is also shown of cloth pinions driven by electricity.

General Motors Truck Company, Detroit, is showing a 1-ton test car chassis, a hotel bus of fifteen-passenger capacity, speed 14 m.p.h., and a 3-ton truck, speed 9 m.p.h. The batteries are carried on the chassis and a flexible steel drive shaft is used.

General Vehicle Company, Boston, shows a 5-ton brewery truck, a 2-ton truck, a 2-ton chassis, a 750-lb. wagon chassis; two 1-ton industrial trucks of recent design and a 1-ton traveling electric hoist with Sprague elevating motor. The improved chain housing of the trucks is emphasized.

Globe Earphone Company, Boston, is showing its regular products in aid of the deaf.

Goulds Manufacturing Company, Seneca Falls, N. Y., is showing a variety of pumps, both steam and electrically driven, for pneumatic, vacuum, oil and water service.

Gould Storage Battery Company, Boston, is showing cells for mining locomotive and train lighting service, a cell for submarine boat operation and an automatic train-lighting and ignition set.

Gray & Fiske, Boston, are showing the "Handy lamp," a portable incandescent service fixture.

Joseph E. Greene Company, Boston, is displaying wiring fittings, fans, motors and Wirt "delite" insulating joints.

F. S. Hardy & Company, Boston, is showing a line of supplies, including "Vulcan" heaters, "Ericsson" telephones, "Monarch" vacuum cleaners, lamps and condulets.

Haskins Glass Company, Wheeling, W. Va., is exhibiting a full line of Tiffany iris glass, ornamental shades, "Lucida" glass and diffusion reflectors.

Hawley School of Engineering, Boston, has a complete exhibit of apparatus used in its electrical courses, including phase-relation demonstrators, generators, motors, transformers and auxiliary equipment.

Hill, Clarke & Company, Boston, is showing electrically driven machine tools, including saws, drills and lathes.

Holophane Company (Nelite Works of General Electric Company), Cleveland, Ohio, is showing iris glass, prismatic steel, reflectors, "Pyro" cut-glass ware and etched globes.

Holtzer-Cabot Electric Company, Brookline, Mass., is showing an automobile lighting dynamo and motor-driven separator, polisher, drills and telephone exchange motors and generators.

H. W. Johns-Manville Company, Boston, is showing a full line of "J-M" fiber conduit for carrying heavy cables, line material, a new asbestos wood switchboard designed not to flake or crack, and a No. 2 Audiffren-Singrun refrigerating machine of novel design.

Kinetic Engineering Company, Philadelphia, is showing a ¾-hp motor-driven organ blower with ball bearings, capacity 800 cu. ft. per minute at 3-in. air pressure, machines of this type being built for both alternating-current and direct-current service.

Kinney Manufacturing Company, Boston, is showing a new ¼-hp rotary compressor with motor drive for air-brush work in dentistry, a 2-hp tire-charging and gas-engine starting outfit built for garages, operating at 200 lb. per square inch, and a portable garage air-compressor outfit driven by a 2-hp motor. A positive rotary pump is the noteworthy feature.

C. S. Knowles, Boston, is showing flexible conduits, strain insulators, "Boston F & S" switches, Goodall unions and insulators.

Lansden Electric Vehicle Company, Newark, N. J., shows a 1000-lb. delivery wagon and two trucks of 1-ton and 2-ton capacity, equipped with Edison batteries. The 2-ton truck made a trip unloaded from Newark to Boston, 295 miles, in thirty-four hours' actual running time, the average speed on the road being 8.6 miles per hour. The trip consumed 189 kw-hr. of energy, making the energy cost about 3 cents per mile on the 4-cent per kw-hr. rate.

Lewandos, Boston, is operating a complete commercial laundry and cleansing plant by motor-drive.

F. T. Ley & Company, Springfield, Mass., are showing a concrete balustrade and pylons, and photographs of hydraulic and railway construction work.

E. S. Lincoln, Inc., Brookline, Mass., is showing high-tension testing facilities, including a 200,000-volt, 100-kva transformer and switchboard equipment for advanced insulation experiments and trials.

Lundin Electric Machine Company, Boston, display new single-lamp and double-lamp standards equipped with G. E. luminous inverted arcs for ornamental street service, the arc being carried 14.5 ft. above the ground, with fuses and switch in the base of the fluted column.

Donald MacDonald, Boston, has an exhibit of leaded glass, semi-indirect lighting fixtures and shades.

Massachusetts Institute of Technology, Boston, is showing diagrams of its courses, statistics of graduates and student activity, charts and photographs. A meter-testing exhibit is also being maintained.

McKenney & Waterbury Company, Boston, is exhibiting "Equalite" lighting fixtures for semi-indirect service.

Metropolitan Engineering Company, Brooklyn, N. Y., is showing a working model of its alternating-current network protector and a line of protective apparatus, including high-tension switches, fuses and connection blocks.

Minerallac Company, Chicago, are showing cable and conduit hangers, contact-making motors, the "maxicator," compounds and insulating material and tape.

Moneyweight Scale Company, Boston, has an exhibit of a motor-driven meat shaver.

John J. Myer, Boston, is displaying a full line of iron-clad switches and motor starters, arc-less fuses and interior conduit material.

Murphy Iron Works, Detroit, Mich., show photographs of stokers and smokeless furnaces.

National Acme Manufacturing Company, Boston, is showing a multiple spindle screw machine and sundries.

National Electric Lamp Association, Cleveland, Ohio, is showing samples of tungsten lamps of a wide range of sizes and is contrasting them with carbon filaments, a wheel showing that the tungsten lamp can be operated in any position.

New England Telephone & Telegraph Company, Boston, has an elaborate display showing the detailed front and rear operation of a four-position common-battery switchboard which is telephone headquarters for the show, cables of from 1-pair to 600-pair capacity, a full-sized elevated manhole with daily cable-splicing demonstration, early forms of telephone apparatus, model showing method of handling a single call, counter showing addition of a new subscriber to the Bell system every forty-two seconds, and a map showing by illuminated figures on a moving roll the telephone toll charges between Boston and New England cities indicated by changing miniature lamps.

New Hampshire Section, National Electric Light Association, is maintaining quarters at the show where visitors are welcomed, and is distributing a booklet on the Rockingham plant at Portsmouth.

New Home Sewing Machine Company, Orange, Mass., is showing its equipment operated by motors.

Ohio Electric Car Company, Toledo, shows a five-passenger model "X" de luxe car, speed 24 m.p.h., with patented magnetic control and straight-shaft drive.

Fig. 2—Entrance of Electric Vehicle Exhibit, Exhibition Hall.

Old Colony Trust Company, Boston, is maintaining a "change-making" bank branch at the show, money being transferred by an electric automobile.

Otis Elevator Company, Boston, is operating a 40-ft. model of an alternating-current automatic push-button elevator and is showing factory and escalator photographs.

H. T. Paiste Company, Philadelphia, is showing a new line of pipe taplets from ½ in. to 4 in. in diameter, only three covers being required for six sizes, and a new fusible plug with permanent holder and detachable fusette saving 2 cents per fuse blown after two replacements of the fusette.

George Lincoln Parker, Boston, is exhibiting an electrically operated piano player with hand and foot attachments.

J. H. Parker, Boston, is showing insulators, molded insulation parts and fittings, including battery boxes.

Pettingell-Andrews Company, Boston, is occupying a suite of seven beautifully furnished rooms in Grand Hall, where the company is showing domestic motor-driven apparatus, "Ever-Ready" supplies and selected lighting shades and fixtures from the company's studios.

Philadelphia Storage Battery Company, Philadelphia,

is showing plates and battery parts with progressive steps of the past six years leading to a 45 per cent increase in capacity and a decrease in weight in a fixed size of jar. These improvements have increased the radius of a 5-ton truck from 12½ to 20 miles.

Otto J. Piebler, Boston, is displaying a fur-cleaning machine driven by a ¼-hp motor, the machine containing about forty straps ¼ in. in diameter and 18 in. long and operating at about 350 r.p.m.

Herbert S. Potter, Boston, is showing rectifiers, yacht-lighting batteries, Edison battery controllers, flashers, "E. C. K." dynamos and motors and automobile lamps, including a step lamp for use in the under side of the door.

Samuel L. Prentiss, Boston, is exhibiting a line of "Invincible" vacuum cleaners specially designed for decreased weight, and a line of Copeman electric ranges with detachable heating units and automatic switching arrangements utilizing the fireless cooker principle.

Printograph Sales Company, Boston, is showing a new letter-copying machine which prints a different address uniform in type and ink at the head of the body of each copy. The output is 2000 letters per hour, compared with 1000 "fill-ins" per day by a typist. The machine is directly driven by a 1/6-hp motor.

Pyrene Company of New England, Boston, is demonstrating the non-conductivity and arc-extinguishing characteristics of pyrene.

Ramsey-Vance Sales Company, Madison, Wis., exhibits an electric silver-cleaning pan of the electrolytic type.

Rauch & Lang, Cleveland, Ohio, D. C. Tiffany, Boston, show a four-passenger landaulet and a brougham with two extra head-lamps, full-skirted fenders carried flush with the car body and a new glass rain visor protecting the wind shield in stormy weather.

Frank Ridlon Company, Boston, is showing a full line of electric-railway supplies and emphasizing its maintenance facilities.

Rivett Lathe & Grinder Company, Brighton, Mass., is showing a line of grinders, bench and percussion lathes.

Robb Engineering Works, South Framingham, Mass., are exhibiting boiler parts.

Robins Conveying Belt Company, New York, is exhibiting a motor-driven model of sand and gravel conveying machinery, with photographs of typical installations.

Rounds Electric Company, Boston, is displaying electrically lighted artificial flowers.

Simplex Electric Heating Company, Cambridge, Mass., is exhibiting a line of electric ranges, domestic and hospital heating devices, including a 200-watt water boiler with a three-heat switch. A novelty is a miniature electric range for a child's doll house.

Franklin A. Snow Company, Boston, is showing views of underground construction, an electrically driven concrete mixer and a display of lamp conduits.

C. H. Sprague & Son, Boston, are showing an electrically driven working model of a West Virginia soft coal mine.

Stone & Webster Engineering Corporation, Boston, is exhibiting large photographs and drawings of its latest construction work on power houses, dams, hydroelectric plants, railways, substations and office buildings, including the newly completed plant of the Boston Elevated Railway Company, the Keokuk plant of the Mississippi River Power Company and large engineering works in the Puget Sound district.

Stuart-Howland Company, Boston, is showing "Excello" lamps, "Regina" vacuum cleaners, "Hot Point" flat-irons, heating and lighting materials.

Studebaker Company, South Bend, Ind., is exhibiting a 4000-lb. truck with stake body, a 1000-lb. express body truck, both designed for either Edison or Exide battery, and one of three 1000-lb. delivery wagons which have been used three and one-half years by the *Christian Science Monitor* of Boston.

Toledo Electric Welder Company, Cincinnati, Ohio, is exhibiting spot welders for stove and hollow work, including a welder for aluminum wire.

Tufts College Engineering School, West Medford, Mass., is exhibiting motor apparatus built by students, and photographs of construction work in charge of graduates.

Underhill Company, Boston, agents for the Grinnell car, is showing the latest model coupé with Earnsdale whipcord lining and solid tires.

United Electric Apparatus Company, Boston, is showing time-limit relays, wiring material and instruments for railway signal service.

United Shoe Machinery Company, Boston, has a Goodyear welt machine and a stitcher in operation, each driven by a ½-hp motor.

Vacuum Sales Company, Boston, is showing the Eureka vacuum cleaner.

Vermont Electrical Association is keeping open house at the show and is displaying Harrigan's lighting specialties.

Wagner Electric Manufacturing Company, Boston, is showing a single-phase motor of high power factor and rectifier sets.

Walker Vehicle Company, Chicago, is showing 2-ton, 1½-ton, 1000-lb. and 750-lb. trucks and delivery wagons, with sectional wheel showing operating features of balanced gear drive.

Ward, Drouet & Foster, Boston, are showing a new ⅓-hp Bissell vacuum cleaner, "Delco" heating appliances, a 1/30-hp sewing machine motor with a stitching range of 1 to 1500 per minute, Hubbell sockets and switches, and Steel City outlet boxes, fire-alarm apparatus, Selmore signs, and arc lamps.

Waterbury Company, New York, has made a display of an insulating mill and a braiding machine, with samples of insulated wire and rope.

Waverley Company, Boston, show a five-passenger limousine, a four-passenger Louis XIV coach and a four-passenger car equipped with Pullman seats. A 600-lb. truck is also shown.

Western Electric Company, Boston, is exhibiting a large assortment of motors, heating devices, domestic and industrial apparatus operated by motors, receptacles and telephone supplies. The company also has an installation of eighty loud-speaking telephones scattered throughout the building and used in general announcement work.

Western Novelty Company, New York, is showing a double soap-bubble-pipe machine operated by an electric motor.

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is exhibiting a line of general-utility motors, rheostats, heating apparatus, fans, switchboard instruments, a motor-driven grinder, vehicle motors and materials and steps used in the manufacture of tungsten lamps.

Wetmore-Savage Company, Boston, is showing a line of Sangamo meters, polyphase motors, wiring materials, Simplex heating devices and Allis-Chalmers transformers, Bryant electric switches, wire and Columbia dry batteries.

Wheeler Reflector Company, Boston, is exhibiting its well-known products for street-lighting service and a transparency contrasting daylight with artificial illumination by photographic methods.

D. Whiting & Sons, Boston, is operating a motor-driven milk depot, with pasteurizing, bottling, capping and filling machines in service.

Industrial and Financial News

ALTHOUGH some hesitancy is noticeable in future commitments for large amounts, due possibly to uncertainty over the political outcome, buying in the majority of lines is on an active scale and is fully equal in volume to that of recent years at this time. Early delivery is being sought more and more in nearly all industrial transactions. Stocks are low, prices are attractive and the time is undoubtedly favorable for healthy expansion. Bank clearings showed an increase of nearly 2 per cent last week over those in the week preceding, and of more than 8 per cent over those in the corresponding week last year. Offerings of bonds of the Philadelphia Company and the General Electric Company were heavily oversubscribed this week. Many offerings of public-utility securities at this time to obtain funds for improvements and additions may be taken as indications of activity in that field. The Ozark Power & Water Company will soon place its new station on the White River, Missouri, in operation. Incorporation of new electrical companies, both manufacturing and central-station concerns, is very pronounced at present. The Allis-Chalmers Company reports numerous sales of large reciprocating engines and, in company with several other electrical manufacturers, a substantial growth in its business. The president of the General Vehicle Company, as noted below, considers the outlook in the electric vehicle field very encouraging.

General Vehicle President on the Commercial Vehicle Outlook.—P. D. Wagoner, president of the General Vehicle Company, Long Island City, N. Y., discussing conditions in the electric commercial vehicle industry this week, said in part: "The development of the electric commercial vehicle industry has shown some particularly interesting phases in the past twelve months. Among these may be mentioned the following: (1) The increase in orders received this year over those in 1911. (2) The wonderful percentage of repeat orders, which in our case in 1911 was 69.4 per cent, and thus far in 1912 is well over 65 per cent. (3) The encouraging increase in "small wagon" business, as compared with the situation in previous years when the use of heavy trucks greatly predominated and department stores and retailers favored non-electrics. (4) The increase in sales to retailers who own from two to six horses and to whom the purchase of even our smallest wagon often meant a heavy initial investment. We have won their confidence and have shown them that they can make electrics pay as well as the big firms do. (5) The fairer attitude of the public toward the electric. (6) The recognition by business men of the respective fields of the electric and the gasoline vehicle and of the importance of buying the proper vehicle for each class of work. (7) The increase in battery efficiency and the encouraging decrease in the cost of energy to off-peak users. I look for the electric truck and wagon to improve still more in operating efficiency as actual service under varied conditions yields its secrets, with the result that electric vehicles will be handled more intelligently. As to the future of the electric vehicle, that is largely in the hands of its friends. If quality of product and adaptability in marketing are maintained, the time should come when 75 per cent of the transfers and deliveries in its field will be performed by the battery-driven vehicle."

Ozark Power & Water System Nearing Completion.—So far as can be foreseen at this time, the hydroelectric development of the Ozark Power & Water Company on the White River at Branson, Mo., will be in operation by April 1, 1913, which is the time originally planned. Energy from this station, in which the initial installation will be 15,000 hp, will be transmitted to Springfield, Mo., and the Ozark company's transmission system will also be tied in with that of the Empire District Electric Company, at Joplin, Mo., as was described in detail in these columns on Feb. 24, 1912, when the plans of H. L. Doherty & Company for financing the project were given. It is expected that the dam will be ready to impound water by Feb. 1, 1913; that the reservoir will be full by Feb. 15, and that the entire plant will be in operation by April 1, 1913, as above. The transmission line from Joplin to Springfield and the installation of substation equipment are almost completed, and the company will be ready to deliver energy in Springfield by Nov. 1, 1912. Until the time when energy can be furnished from the Ozark company's plant the service over this line to Springfield will be supplied from the steam generating stations of the Empire District Electric Company. When the Ozark plant is ready for operation the Empire District Electric Company will become a purchaser of the excess energy developed by it and will also serve as a reserve to the Ozark company. About 400 men are now at work on the dam and power house.

Demand for Large Reciprocating Engines.—Recent sales of Corliss engines made by the Allis-Chalmers Company include a number of large units. Among these are a twin tandem compound reversing engine, 40 in. and 66 in. by 60 in., for the Minnesota Steel Company, Duluth, Minn.; a tandem compound rolling-mill engine, 50 in. and 78 in. by 60 in., for the Carnegie Steel Company, Bessemer, Pa.; an 18-in. and 30-in. by 36-in. cross-compound direct-connected unit for the Northwestern Iron Company, Maysville, Wis.; two 20-in. and 42-in. direct-connected engines for the Illinois Vinegar Manufacturing Company, Chicago; belted engines for the American Trading Company, New York, the city of Lamar, Mo., and Henry Seers, Inc., New York, and a 30-in. and 46-in. by 42-in. cross-compound direct-connected engine for the Charles Netcher Estate, Chicago (Boston Store). The last named includes a 750-kw direct-current generator, built also by the Allis-Chalmers Company and especially interesting from the fact that the terminal pressure is only 120 volts, the low voltage being unusual for a machine of this size. The generator has a single commutator and is supplied with interpoles. Units of this character find a place in large office and mercantile buildings, and the manufacturer believes that they are likely to grow in favor.

Pelton Waterwheels for Cuban Plant.—The initial generating equipment for the central station that is being built for the Madrazos Hydroelectric Company, about 20 miles from Cienfuegos, Cuba, and which will supply energy for use in that city, will consist of three 440-hp Pelton waterwheels direct-connected to General Electric generators. The wheels will operate at 900 r.p.m. under an effective head of 1200 ft., and will be equipped with Pelton governor-controlled needle nozzles and automatic by-passes. The generators will be equipped with direct-connected exciters. The generators will furnish three-phase, 60-cycle energy at 2300 volts, and this will be raised to 23,000 volts for transmission to Cienfuegos. The transmission line is nearly completed. Provision has been made for doubling the initial installation in the future. The Pelton company will also furnish 6500 ft. of riveted and welded steel pipe, 15 ft. in diameter, for the Cuban company. It has just shipped three 3600-hp waterwheels for use on the Panama Canal.

Good Business in Arc-Lamp Posts.—"Our post business," said M. J. Maroney, of the J. L. Mott Iron Works, 118-120 Fifth Avenue, New York, this week, "is very gratifying, both as to volume and prices. The demand in the East at present is chiefly for arc-lamp posts, and the scroll bracket type is the one mostly in favor. In other parts of the country the twin-arc type is in greater demand. There is not as much of a demand for 'tungsten' posts as there has been, although there is some interest shown in these in the South and Southwest. Our export business is very good. We are selling large numbers of ornamental tungsten posts and ornamental designs, such as fountains, to South American cities. The showing of all departments of our business compares very favorably with last year's records."

American Steel & Wire Business Expanding.—During the month of September a new high record of production and incoming business was made by the American Steel & Wire Company, as compared with the corresponding months in previous years. Incoming orders averaged close to 7500 tons per day, which is much in excess of production. The outlook for October is also promising.

Say That Long Acre Litigation Will Continue.—Further information has developed concerning the report published in these columns in the previous issue that a majority of the $500,000 4 per cent bonds of the Long Acre Electric Light & Power Company, of New York, which has been seeking for several years to establish itself as a competitor to the New York Edison Company, were sold at private sale last week to interests associated with the last-named concern. It is stated on good authority that, while neither the New York Edison nor the Consolidated Gas Company, which controls it, was directly concerned in the transaction, the bonds were purchased by a large stockholder of the Consolidated Gas Company. The plan, it is understood, was to bring about foreclosure proceedings, based upon the fact that the interest on the bonds has been long in default, obtain control of the company at foreclosure sale, and turn it over to the New York Edison Company. Officials of the latter and of the Consolidated Gas Company have denied that the companies were concerned in the purchase of the bonds and say that the litigation to prove the franchise invalid will continue. Interests associated with the Intercity Power Company, which, as noted in the *Electrical World* Sept. 7, was formed to succeed the Long Acre company, say that the sale will make no difference in their plans, as it is possible that the New York Edison would be outbid at a foreclosure sale if one took place.

Seek to Consolidate Maryland and Delaware Companies.—A petition has been filed with the Maryland Public Service Commission asking for permission to consolidate the Patapsco Electric & Manufacturing Company of Maryland and the Patapsco Electric & Manufacturing Company of Delaware into the Patapsco Electric Company. The petition sets forth that the old companies have operated in conjunction in Baltimore and Howard Counties, that title to land, water rights, building and machinery at the plants located at Grays and Ilchester, on the Patapsco River, is vested in the Maryland company, and that title to rights-of-way, poles and the transmission system generally is in the Delaware company. It has been found inconvenient to conduct the business further through the two companies. The stock of the proposed new company will be $200,000, divided into 20,000 shares of the par value of $10 each. Of this $145,000 will be issued. The consolidation contemplates a bond issue of $280,000 in denominations of $1,000 each, bearing interest at 5 per cent.

Massachusetts Company Financing Improvements.—The Gardner (Mass.) Electric Light Company has petitioned the Gas and Electric Light Commission for authority to issue 400 shares of additional preferred stock and 400 shares of new common stock for the purpose of paying the cost of a transmission line to South Barre, the construction of distributing lines and substations in the towns of Westminster, Hubbardston and Barre, and for meeting the cost of improvements lately effected and in further prospect in its local plant and distributing system at Gardner. The total amount of indebtedness incurred on these accounts is about $102,000. The company desires to issue the preferred and common stocks at $105 and $150 per share respectively. The company is controlled by interests identified with the Connecticut River Transmission Company and distributes a considerable amount of hydroelectric energy in northern Worcester County.

Philadelphia Company's Debentures Sold.—In order to provide the Philadelphia Company with funds for further improvement and development work to meet the needs of the large territory in which it operates and to purchase additional public-utility properties, the unsold portion of the $10,000,000 5 per cent convertible debentures which the stockholders authorized on April 29 last, as was noted in these columns May 4, were sold this week by Blair & Company and Ladenburg, Thalmann & Company, and also by London bankers. The offering was made at 97½ and accrued interest and was heavily oversubscribed. The Philadelphia Company was organized in 1871 and is one of the largest public-service corporations in the country. It is engaged in supplying both natural and artificial gas, electrical energy and street-railway service in Pittsburgh and its suburbs. In the last fiscal year the balance of earnings available for interest on the $10,000,000 convertible 5 per cent debentures of 1912 was $4,415,621.

Baltimore Utility Has Good Year.—The annual report of the Consolidated Gas, Electric Light & Power Company of Baltimore shows that its gas output increased 8 per cent and the output of electric energy increased 43.6 per cent. The increase in the company's net earnings totaled $410,063.38, or 17 per cent. The report, which will be submitted at the annual meeting to be held Oct. 7, shows the following results: Gross income, $5,465,287; operating expenses and taxes, $2,642,887, and the net earnings, $2,822,399. Fixed charges were $1,417,267.86, leaving net income of $1,405,131. Dividends paid and payable amounted to $744,749, leaving a balance of $660,381.96. The reserve for renewals, etc., is $455,526.64, leaving a net surplus of $204,855.32.

Progress of Washington (D. C.) Utilities Merger.—Following the recent incorporation of the $30,000,000 Maryland-Virginia Company, which was formed to effect a merger of the public utilities in Washington and elsewhere in the District of Columbia, as was briefly noted in these columns Sept. 21 the directors of the Arlington Electric Light Company and the Braddock Electric & Power Company have voted to consolidate with the Maryland-Virginia Company. It is now understood that the latter plans to acquire the common stock of the Washington Railway & Electric Company, to sell more of its own securities, and with the proceeds acquire the stock of the other utilities in the District.

York (Pa.) Company Sold.—Interests affiliated with the Edison Electric Light Company of York, Pa., have taken over the properties of the York & Windsor Electric Light Company by the purchase of practically all of its stock and bonds. It is expected that improvements will be made in the physical condition and in the service. The following new officers and directors were elected: John B. Landers, president and director; S. H. Ludwig, secretary, treasurer and director; Joseph E. Wayne, A. J. Hershey and E. Philip Stair, directors. These replaced George A. Kohler, president; Michael Hose, Horace Welty, C. S. Lamotte and John N. Flinchbaugh, resigned.

Eastern Texas Electric Company Improvements.—Stone & Webster have sold a new issue of $550,000 6 per cent cumulative preferred stock of the Eastern Texas Electric Company at 90, to yield 6.65 per cent. This company, under Stone & Webster management, owns the securities of the company doing the entire electric lighting business of Beaumont, Tex. The proceeds from the sale of this issue of preferred stock will be applied to the purchase of the electric lighting and refrigerating properties in Port Arthur, about 20 miles distant from Beaumont, and to further additions and improvements.

H. M. Byllesby & Company Said to Be Seeking Control of Merchants' Heat & Light Company, Indianapolis.—It is reported from Louisville, Ky., that a syndicate of local business men, headed by Henning, Chambers & Company and L. H. McHenry, who have been identified with H. M. Byllesby in recent negotiations for Kentucky electric properties, is now negotiating for a controlling interest in the Merchants' Heat & Light Company of Indianapolis.

Virginian Power Company Organized.—The Virginian Power Company has been incorporated under Massachusetts laws with a capitalization of $10,000,000. This is divided into 50,000 shares of 6 per cent non-cumulative preferred stock and 50,000 shares of common stock, par value being $100. The new concern will have offices in Boston and Charleston, W. Va. It will engage in the development of water-power.

General Electric Bonds Oversubscribed.—The $10,000,000 5 per cent gold debenture bonds of the General Electric Company, to which reference was made in these columns last week, were largely oversubscribed this week when offered by J. P. Morgan & Company and Lee, Higginson & Company, in connection with Morgan, Grenfell & Company, of London. The price was 99¾ and interest.

Kansas City Railway & Light Notes.—Announcement has been made by the committee representing the holders of the 6 per cent five-year gold notes of the Kansas City Railway & Light Company, which matured Sept. 1, 1912, that a majority of the notes was deposited under the reorganization agreement of Aug. 15, 1912.

May Sell Springfield (Ohio) Light, Heat & Power Company.—Stockholders of the Springfield (Ohio) Light, Heat & Power Company, who some time ago deposited their holdings with the Central National Bank under option to sell to Hodenpyl, Hardy & Company, of New York, have received $1 per share as a guarantee payment on the purchase. This firm agreed to take the stock if 80 per cent of it could be secured, and thus far 95 per cent of the outstanding preferred stock and 86 per cent of the common stock has been deposited. The purchasers have until Nov. 16 to complete their arrangements for financing the purchase. It has been stated that the property will be placed in another corporation, but the optioning firm is not ready to give any information as to its disposition.

September Incorporations.—Papers filed in the Eastern States for companies with an authorized capital of $1,000,000 and over during September represented $145,050,000, according to compilation by the *Journal of Commerce*, New York. This figure represents an increase of $68,046,000 over that for the same period a year ago, but a decrease of $19,450,000 as compared with the August returns. Charters taken out during the month by other companies with an individual capital of $100,000 and more, but less than $1,000,000, including states other than those in the East, brought the grand total up to $224,165,000, which is an increase over 1911 of $67,253,000.

Will Take Over Wisconsin Utilities.—The Wisconsin Gas & Electric Company has been incorporated in Wisconsin with a capital of $1,200,000. The new concern will be a holding company for the public utility properties of the North American Company in Illinois and Wisconsin outside of Milwaukee. It will take over the public utilities in Kenosha and Racine, Wis., including the plants of the Racine Gas Light Company, the Kenosha Gas & Electric Company and the Kenosha Electric Railway Company.

NEW YORK METAL MARKET PRICES.

	Sept. 24 Bid.	Sept. 24 Asked.	Oct. 1 Bid.	Oct. 1 Asked.
Copper:				
Standard, spot	17.25	.....	17.25	.....
	£ s d		£ s d	
London, standard, spot	78 5 0		78 17 6	
Prime Lake	17.65 to 17.75		17.70 to 17.80	
Electrolytic	17.65 to 17.75		17.70 to 17.75	
Casting	17.60		17.60 to 17.65	
Copper wire, base	19.00		19.00	
Lead	5.10		5.10	
Nickel	45.00		45.00	
Sheet zinc, f.o.b. smelter	8.90		9.00	
Spelter, spot	7.65		7.65	
Tin, spot	.....		50.00	
Aluminum:				
Prompt delivery	.....	.....	24.00 to 25.00	
Future	.....	.....	23.50 to 24.50	
OLD METALS.				
Heavy copper and wire	16.50		16.50	
Brass, heavy	10.50		10.50	
Brass, light	8.75		8.75	
Lead, heavy	4.75		4.75	
Zinc, scrap	6.10		6.10	

COPPER EXPORTS IN SEPTEMBER.

Total tons, week ending	Sept. 24, 19,203	Oct. 1, 25,572

INDUSTRIAL SECURITIES

Security.	Capital Stock Listed.	DIVIDEND. Per Cent.	Period.	QUOTATION. Sept. 25.	Oct. 2.
Allis-Chalmers t. r. 1st assess. paid	17,125,800	.....	.....	½*	½*
Allis-Chalmers pf	2,083,800	.....	.....	2*	2*
Allis-Chalmers pf. t. r. 1st assess. paid	13,966,200	.....	.....	3½*	⅜
Amalgamated Copper	153,887,900	1	Q	90¾	90¼
American Tel. & Tel.	334,303,300	2	Q	146	144½
Crocker-Wheeler, c.	1,700,000	1¼	Q	89*	89*
Crocker-Wheeler, pf.	500,000	1¾	Q	105*	105*
Electric Storage Battery, c.	16,074,425	.....	.....	56⅝	56
Electric Stor. Battery, pf.	175,100	.....	.....	.....	....
General Electric	77,726,700	2	Q	183½	182⅝
Mackay Cos., c.	41,380,400	1½	Q	88*	88*
Mackay Cos., pf	50,000,000	1	Q	68½	68⅞
Western Union Tel.	99,743,400	¾	Q	81⅞	81
Westinghouse E. & M., c.	31,685,300	1	Q	85½	84¾
Westinghouse E. & M., pf.	3,998,700	1¾	Q	124*	124*

*Last price quoted.

ELECTRIC SECURITIES

Q—Quarterly. M—Monthly. S—Semi-annually. A—Annually.

Security	Outstanding.	DIVIDEND. Per Cent.	Period.	LAST QUOTATION. Bid.	Asked
Adirondack Electric Power, c.	$9,500,000	.....	.....	23	26
Adirondack Elec. Power, pf.	2,500,000	.....	.....	65½	67½
Amer. Gas & Electric ($50), c.	2,500,000	1¾	Q	90	95
Amer. Gas & Electric ($50), pf.	1,537,500	1½	Q	49	50
Amer. Light & Traction, c.	10,395,400	2½	Q	426	428
Amer. Light & Traction, pf.	14,236,200	1½	Q	110	111
Amer. Power & Light, c.	5,631,400	.....	.....	69	72
Amer. Pwr. & Lt., 6% cum pf.	3,106,800	1½	Q	87	87½
Amer. Pwr. & Lt., opt. warr.	1,604,000	.....	.....	13	15
Amer. Pwr. & Lt., 6% notes, '21	2,199,100	3	S	97½	99½
Appalachian Power, c.	6,000,000	.....	.....	25¾	26¼
Appalachian Power, pf.	2,180,000	.....	.....	74¼	75½
Arizona Power, c.	3,000,000	.....	.....	10	15
Arizona Power, pf.	850,000	.....	.....	50	55
Ashville Light & Power, 1st s. f. 5s, '42	1,100,000	2½	S	93	96
Augusta-Aiken Railway & Electric, s. f. 5s, '35	2,800,000	2½	S	90	95
Augusta-Aiken Ry. & Elec., c.	2,250,000	1½	.....	25	35
Augusta-Aiken Ry. & Elec., pf.	1,500,000	1½	Q	75	85
Augusta Railway & Electric, 1st 5s, '40	967,000	5	S	101	....
Butte Electric & Power, c.	4,000,000	1¾	Q	140	145
Butte Electric & Power, pf.	1,000,000	1½	Q	79½	80½
Butte Elec. & Pwr., 1st 5s, '51.	4,283,000	2½	S	95	97½
Central Maine Power 1st 5s.	1,923,000	5	A	97	99
Cities Service, c.	5,499,430	½	M	121¾	122
Cities Service, pf.	10,195,360	½	M	89¾	91½
Columbus Railway Gas & Electric, 1st 5s, '36	2,454,000	2½	S	94	95
Columbus Ry. G. & Elec., c.	2,000,000	.....	.....	60	100
Columbus Ry. G. & Elec., pf.	840,000	1½	Q	85	93
Commonwealth Edison cap. stock	32,964,800	7	A	138½	....
Consolidated Gas, Electric & Power (Baltimore), 4½s.	11,564,000	2½	S	88	88½
Consum. Pwr. (Mich.), 5s, '36	8,407,000	2½	S	96	98
Consumers Power (Minn.), 1st 5s, '29	9,539,500	2½	S	89½	92
Dallas Elec. Corp., 5s, '22	3,659,000	2½	S	95	98
Denver Gas & El. Lt., c.	7,001,300	¼	M	220	....
Denver Gas & El. Lt., gen. 5s,	6,000,300	2½	S	95	97
Empire District Electric, 5s.	1,925,000	2½	S	87	88
Edison El. Ill. of Boston, cap. stock	15,603,700	2½	Q	290*	....
Federal Light & Traction, c.	4,750,000	.....	.....	35½	37
Federal Light & Traction, pf.	2,500,000	1½	Q	84	85
Kings County El. Lt. & Pwr.	10,000,000	2	Q	130	134
Niagara Falls Power, 5s, '32.	10,000,000	2½	S	101¼	102¼
Northern Ohio Railway & Light, 4½s, '35	17,544,000	2¼	S	87⅛	87½
Northern States Power, c.	5,975,000	.....	.....	27½	30
Northern States Power, pf.	8,386,700	1¾	Q	88	90
Pacific Gas & Electric, c.	31,908,750	1¼	....	63½	64½
Pacific Gas & Electric, gen. and ref. 5s, '42	20,000,000	2½	S	91	91½
Pacific Gas & Electric, pf.	10,000,000	1½	Q	92⅛	92½
Philadelphia Electric ($25)	24,987,750	1½	Q	23⅛*	23⅜
Portland General Electric, 5s.	8,000,000	2½	S	101½	102½
Republic Railway & Light, c.	5,200,000	.....	.....	27	29
Republic Railway & Light, pf.	6,360,000	1½	Q	81	83
St. Joseph's R. L. H. & P., 5s.	4,250,000	2½	S	99½	100
Seattle Electric Co. Cons.	7,417,000	2½	S	98	100
Southern California Edison, c.	7,200,000	1¼	Q	82¼	83
Southern Calif. Edison, con. 5s, '29	9,975,000	2½	S	96	98
Southern Power, 5s.	4,000,000	2½	S	99½	101
Standard Gas & Elec. ($50), c.	9,343,150	.....	.....	$23½	$24
Standard G. & Elec. ($50), pf.	10,977,950	2	Q	$50½	$51
Tennessee R. L. & Pwr., c.	20,000,000	.....	.....	24¾	25½
Tennessee R. L. & Pwr., pf.	10,250,000	1½	Q	79	79¾
Tri-City Railway & Light, c.	9,000,000	.....	.....	55	....
Tri-City Railway & Light, pf.	2,826,200	1½	Q	90	96
Tri-City Ry. & Lt., 5s, '23.	8,207,000	2½	S	97¾	....
Western Power	14,670,000	.....	.....	29½	30½
Western Power, 6% cum. pf.	6,000,000	6	.....	59½	60½

Personal

Dr. William Marconi, the injury to whose eye was noted last week, is improving satisfactorily and it is now believed that the injury will not prove permanent.

Mr. J. F. McLaughlin, of Philadelphia, Pa., has been engaged by the Board of City Commissioners of Atlantic City, N. J., to frame a code of electrical regulations.

Mr. Floyd N. Dull, for several years secretary for the Home Telephone Company of Detroit, Mich., will shortly assume the management of the Valley Telephone Company properties.

Mr. John F. Griffin has been appointed secretary-treasurer of the Chicago Mica Company, with which company he has been associated for many years, succeeding Mr. E. H. Heilstedt, resigned.

Mr. R. J. Mack, manager of the new-business department of the Fort Smith (Ark.) Light & Traction Company, has been appointed secretary of the Arkansas-Oklahoma Interstate Fair Association.

Mr. F. B. Lewis, formerly engineer of light and power in the department of distribution of the Southern California Edison Company, has been promoted to the position of superintendent of the Los Angeles district.

Mr. Paul Newell, of the Woonsocket (R. I.) Electric Machine & Power Company, has recently become associated with the Columbus (Ga.) Electric Company. **Mr. George L. Davis** succeeds to the position occupied by Mr. Newell.

Mr. Walter W. Dearth, formerly superintendent of the Pana (Ill.) Gas & Electric Company, has resigned his position to engage with a manufacturing company at Muncie, Ind. He is succeeded by **Mr. H. I. Nutt,** of Taylorville, Ill.

Mr. Harold Almert, manager of the examinations and reports department of H. M. Byllesby & Company, addressed the Byllesby Luncheon Club in Chicago on Sept. 25 on the subject of "Business Science and Personal Efficiency."

Mr. Nelson L. Pollard has been appointed electrical engineer of the Public Service Electric Company, Newark, N. J. Owing to a typographical error in last week's issue the name of the electrical engineer was given as Mr. H. L. Pallard.

Mr. W. D. Weaver, formerly editor in chief of the *Electrical World* and now consulting editor, sails on Monday for Nice, France, where he will spend a short vacation. Mr. Weaver has chosen a slowgoing vessel so as to obtain all of the benefits of the ocean trip.

Mr. W. L. Bird, of Fort William, Ont., the first vice-president of the Canadian Electrical Association, has assumed the office of president of the association, owing to the resignation of **Mr. R. F. Pack. Mr. C. A. Bowden,** of Toronto, was appointed secretary at a recent meeting.

Mr. J. T. Huntington has been appointed manager of the Santa Barbara Gas & Electric Company, Santa Barbara, Cal., in place of **Mr. S. C. Haver, Jr.,** acting manager, who has returned to his regular post as assistant district agent of the Southern California Edison Company in Los Angeles.

Mr. C. L. Cory, professor of electrical engineering at the University of California, has been made the recipient of the gold medal of the Pacific Coast Gas Association for a paper on "Reasonable Gas Rates and Their Determination." The paper outlines a method of rate determination which is just to the public and to the corporation.

Mr. Thomas Eslinger, formerly connected with the Toledo Railways & Light Company, has resigned from that company to become superintendent of the Rockford & Interurban Railway Company, Rockford, Ill. Mr. Eslinger will be succeeded by Mr. William Condon, formerly night dispatcher with the Toledo Railways.

Mr. A. B. Hitzel, formerly connected with the Eastern Pennsylvania Power Company, Easton, Pa., and with the South Carolina Light & Power Company, Raleigh, S. C., has been appointed manager of the commercial department of the Elmira Water, Light & Railroad Company, Elmira, N. Y., vice **Mr. T. B. Rhodes,** resigned.

Mr. Ralph H. Rice, the recently selected chairman of the Chicago Section of the American Institute of Electrical Engineers, is the division engineer of electrical transmission and distribution for the Board of Supervising Engineers, Chicago Traction. He is a graduate of Armour Institute of Technology and was formerly connected with The Arnold Company.

President Carl A. Rossander, of the Swedish Electrochemical Committee, Stockholm, and **Dr. Alfred Ekström,** managing director of the Hemsjö (Sweden) Hydroelectric Power Company, who have made a tour through the eastern portion of the United States for the purpose of studying recent developments in central-station practice, returned to Sweden on Oct. 1.

Mr. Val. A. Fynn, consulting engineer to the Wagner Electric Manufacturing Company, has returned to St. Louis from a trip throughout Europe occupying three months, much of which time was spent in the strenuous exercise of mountain climbing. Mr. Fynn is the inventor of the unity power-factor, single-phase motor now being marketed by the Wagner company.

Mr. W. W. Ryder on Oct. 1 assumed the newly created position of manager of the railway department of the Western Union Telegraph Company, with headquarters in New York City. He is widely known in railroad-telegraph circles and resigned his position as general superintendent of telegraph of the New York Central lines west of Buffalo in order to accept his new appointment. Mr. Ryder has long been prominent in the affairs of the Association of Railway Telegraph Superintendents.

Mr. Samuel A. Freshney, former general manager of the Muskegon Traction & Lighting Company, Muskegon, Mich., and until recently general manager of the Union Electric Company, of Dubuque, Ia., has severed his connection with the Electric Bond & Share Company, the owner of the property, and returned to Grand Rapids as manager of the Grand Rapids-Muskegon Power Company. Mr. Freshney had scarcely become settled in Dubuque when he received the more flattering offer from Grand Rapids, so that he was in charge at Dubuque for only about a month.

Mr. J. McA. Duncan, who has been appointed Pittsburgh district manager of the Westinghouse Electric & Manufacturing Company in place of **Mr. W. F. Fowler,** who has resigned to accept a position with the W. S. Kuhn Corporation, has been in the employ of the Westinghouse Electric & Manufacturing Company for about twenty-five years and is one of the original group of eight men taken from the Union Switch & Signal Company, then doing business on Garrison Alley, Pittsburgh, to form the Electric Company, which was established at the same place. His first position was in the shipping department, and his second in the correspondence department, of which he was afterward placed in charge. In 1906 he was placed in charge of the price department, and as head of this division of the company he passed on prices of all apparatus manufactured. For a year or two he was stationed in the New York office on some special work in connection with costs. Mr. Duncan then returned to East Pittsburgh and was attached to the manager of works' office as director of costs, and later as assistant manager of works in charge of production and costs. Last spring, when the present revival of industry began, the increased activity resulting from additional business necessitated a division of work, and Mr. Duncan was appointed director of works accounting.

Obituary

Mr. William McCaffrey, of the Canadian General Electric Company's Toronto sales office, his mother, wife and two children were drowned in the Pigeon River, Ontario, on Sept. 29. The party were fishing in a canoe and met accidental death in its overturning from the efforts of Mr. McCaffrey to land a 14-lb. muskallonge which he had hooked. When Mr. McCaffrey's body was recovered a trolling line was clasped in his hands and on the hook was the muskallonge, still alive.

Construction

ALABAMA CITY, ALA.—The Alabama Pwr. Devel. Co. has been granted a franchise to enter Alabama City. The transmission line will be extended from Anniston to Alabama City.

BLOCTON, ALA.—The Galloway Coal Co. is planning to equip its coal mines with electrically operated machinery at a cost of about $30,000. It is understood that contracts have been placed for electrical equipment.

BEAUMONT, CAL.—Notice of appropriation of 6000 in. of water of the Whitewater River to be used for power purposes has been filed by Marcus Platts, of Riverside. The proposed plant will be located north of Beaumont, near the Riverside-San Bernardino county line.

COACHELLA, CAL.—Investigations are being made by A. E. West with a view of securing information as to the amount of business that can be secured for an electric power plant in the Coachella Valley. If established the plant will be financed entirely by outside capital and will cost from $250,000 to $300,000. Benjamin F. Pearson, Los Angeles, is interested.

DIXON, CAL.—Surveys are being made by the Sacramento Valley El. Ry. Co. for an extension from Woodland through Dixon to Denverton, a distance of about 35 miles. C. L. Donohue is interested.

GLENDALE, CAL.—The municipal electric-light department has taken over from the Glendale El. Ry. Co. the electric-light circuit leading to Verdugo Park. H. B. Lynch, city electrician, is planning to place a large part of the distributing system of the municipal service underground. Most of the new ornamental street lamps will be maintained by underground wires. More material will be needed in connection with the work.

LOS ANGELES, CAL.—The City Power Bureau is in the market for high-tension and low-tension switchboards for the generating and receiving stations on the aqueduct power system. E. F. Scattergood is engineer.

LOS ANGELES, CAL.—The Los Angeles Ry. Corpn. has applied to the Council for three electric railway franchises. One is for third-rail privileges on San Pedro Street, from Fifth Street to the old plaza, in connection with the Pacific El. Ry. Co., which asked for a franchise from Ninth to Aliso Streets. The two other franchises are on South Main Street from Thirty-sixth Street to Slauson Avenue and from Slauson Avenue to Manchester Avenue respectively.

PETALUMA, CAL.—The City Council has authorized Mayor William Zartmen to appoint a committee to confer with the Petaluma Pwr. & Wtr. Co. and devise plans for acquiring the plant.

SACRAMENTO, CAL.—The State Railroad Commission has granted the Pacific Gas & El. Co. permission to issue $5,000,000 in bonds for improvements and extensions to its system in California, entailing ultimately a total expenditure of about $12,282,441. The proposed improvements include hydroelectric power plants on the South Fork of the Yuba River in Nevada County and on the Bear River in Solano County opposite Crockett in Contra Costa County, a steam power station in Sacramento, a two-circuit steel tower transmission line from Cordelia to San Rafael, and general extensions and improvements to its system, including new office building in Sacramento and additions to the San Francisco offices. The steam power station in Sacramento will cost about $409,820 and the additions to the San Francisco offices $350,000.

SAN BERNARDINO, CAL.—The Arrowhead Reservoir & Pwr. Co. has applied to the State Railroad Commission for permission to issue $4,000,000 in bonds, the proceeds to be used to complete the Little Bear Valley dam, to construct dams in Grass Valley and at Holcomb reservoir, to build a reservoir on Deep Creek and other work.

SOMESBAR, CAL.—A company has been formed to build a power plant 2 miles above the junction of the Klamath and Salmon Rivers. At this point a tunnel 2 miles long will be bored and water from the Klamath River carried to the Salmon River. Electricity generated at the plant will be used to operate a gold dredger between the dam in Klamath River and the junction of the two rivers. Mr. Langford is engineer in charge of the work.

VALLEJO, CAL.—The contract for furnishing electricity for operating the pumping station at Lake Chabot has been awarded to the Great Western Pwr. Co. The city commissioners recently made arrangements to secure the city water supply from Lake Chabot.

COLORADO SPRINGS, COL.—Steps have been taken to extend the ornamental street-lighting system on Nevada Avenue to Bijou and on Bijou between Nevada Avenue and Tejon Street. Ornamental lamp standards carrying five-lamp clusters will be used. John Argust is a member of the committee.

WILMINGTON, DEL.—Proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Oct. 17 for an electric passenger service and hydraulic freight lift in the extension to the United States post office and court house, Wilmington, Del., in accordance with drawings and specifications, copies of which may be obtained at the above office. Oscar Wenderoth is supervising architect.

WASHINGTON, D. C.—Plans have been completed for the installation of a new street-lighting system on Delaware Avenue and the streets surrounding the Capitol and the Senate and House office buildings, work on which will begin in the near future. An appropriation of $12,000 has been made for the purchase of new lamp standards.

ATLANTA, GA.—Plans have been prepared by R. C. Turner, city electrician, for a municipal arc-lamp system, which provides for 1600 arc lamps and 925 incandescent lamps and 400 ornamental lamp standards.

CAMILLA, GA.—The City Council has called an election to be held Oct. 9 to vote on the proposition to issue $27,500 in bonds, of which the proceeds of $10,000 will be used for extensions and improvements to the municipal electric-light plant and water-works system.

COLUMBUS, GA.—The Columbus Pwr. Co. contemplates the erection of a transmission line from Columbus to Americus to supply electricity there.

DARIEN, GA.—The Council has awarded the Darien Ice & Lt. Co. a contract to light the streets with electricity. Machinery for the proposed plant has been ordered. William H. Blount will have charge of the plant.

BUHL, IDAHO.—I. B. Perrine has submitted a proposition to C. A. Taylor and E. A. Milner, of Buhl, for the construction of an electric line out of Buhl through Castleton to the Salmon River.

CALDWELL, IDAHO.—The Idaho-Oregon Lt. & Pwr. Co. will soon begin work on the construction of a substation and depot in Caldwell, to cost about $75,000.

GRANGEVILLE, IDAHO.—The Rapid River Mining & Milling Co. has acquired a power site and will develop it.

BLOOMINGTON, ILL.—The power plant of the Bloomington & Normal Ry. & Lt. Co. was damaged recently by explosion of one of the boilers.

CHAMPAIGN, ILL.—C. A. Kiler and E. S. Swigert, representing citizens on West Park Avenue, have asked the City Council for permission to erect an ornamental street-lighting system, to cost $1,500, on West Park Avenue, the city to maintain it.

DANVILLE, ILL.—The capital stock of the Danville St. Ry. & Lt. Co. has been increased from $700,000 to $1,500,000, the proceeds to be used to care for increased business and for improvements to the property.

ELGIN, ILL.—The North Spring Street Improvement Association contemplates the installation of an ornamental street-lighting system. E. N. Herbster is interested.

FORESTON, ILL.—The Village Board has accepted the proposition of the Northern Illinois Utilities Co. to install 23 ornamental lamp standards, carrying cluster lamps, in the business district and 36 tungsten lamps of 60 cp in the residential section and to maintain same at a cost of $1,688 per year.

HIGHWOOD, ILL.—The property of the Chicago & Milwaukee El. R. R. Co. was purchased at master's sale on Sept. 25 by Attorney Newman for the bondholders for $1,650,000. The company will soon be reorganized and $10,000,000 in bonds issued, of which $3,000,000 will be spent immediately for betterments and equipment.

ROCKFORD, ILL.—The Central Union Tel. Co. is planning to erect a new direct copper metallic circuit from Rockford to Dixon.

ROCK ISLAND, ILL.—The Tri-City Automatic Home Tel. Co. has filed a petition with the city commission asking that the proposition to grant the company a 25-year franchise be submitted to the voters.

CAMPBELLSBURG, IND.—The City Council has granted J. H. James a 25-year franchise to build and operate an electric-light plant here.

LA PORTE, IND.—Announcement has been made that Fox Brothers have offered to pay one-half of the cost of a lighting system in the Fox Memorial, the cost of which is estimated at $1,500. The La Porte El. Co., it is said, will have to install a new transformer to enable it to furnish the park service.

MILROY, IND.—An electric-light plant is being installed by Charles Witters to supply electricity for lamps during the fall festival. Later the plant will be enlarged and will supply electrical service to the town.

VALPARAISO, IND.—A company has been organized to install an electric plant here. Plans submitted by a consulting engineer estimate the cost of a plant of sufficient output to meet the demands of the city at from $50,000 to $75,000 and the cost of operating same at $15,000 per year.

WEST LEBANON, IND.—The Village Board is contemplating the installation of an electric-light plant.

CEDAR FALLS, IA.—In the report submitted to the City Council by A. T. Maltby, of Chicago, Ill., consulting engineer, the cost of a municipal electric-light plant for street-lighting is estimated at $30,000, and one to supply electricity for municipal and commercial lighting at $48,000.

CHURDAN, IA.—At an election held Sept. 17 the proposition to appropriate $10,000 for the installation of an electric-light plant and $5,000 for a water-works system was carried.

GLIDDEN, IA.—Plans are being prepared for the erection of an electric-light plant here. Transmission lines will probably be erected to Ralston and Scranton.

GOLDFIELD, IA.—The Park Dam Co., of Eldorado, has been granted a franchise to supply electricity for lamps and motors here.

GREENFIELD, IA.—At an election to be held Oct. 21 the proposition to issue $9,000 in bonds for extensions to the municipal electric-light plant will be submitted to a vote.

HOPKINTON, IA.—The Council has decided to establish its former street-lighting service. It is proposed to erect 16 electroliers on Main Street and 42 suspended lamps throughout the residential district. The city has been without street lamps for some time.

LEON, IA.—The City Council has decided to purchase the property adjoining the railroad track east of the depot for a site for the electric power station. It has not yet been decided whether to use steam or gasoline engines to drive the plant.

MARSHALLTOWN, IA.—Plans are being prepared by the Electric Lighting Department to replace a large number of the old arc lamps with 150-watt lamps, which will make it possible to extend the lighting service.

NORWAY, IA.—At an election held Sept. 23 the proposition to grant the Cedar Rapids & Iowa City Ry. & Lt. Co. a franchise to supply electricity for lamps and motors here was carried. The town has also contracted with the company for street lighting.

OTTUMWA, IA.—Plans are being considered by Otil T. Hare, of Quincy, Ill., and associates for the construction of electric interurban railways radiating from Ottumwa.

OTTUMWA, IA.—The Ottumwa Ry. & Lt. Co. is planning to extend its railway out on Court Street beyond the Ottumwa Country Club to the corner of Grand Avenue and Prairie Avenue.

RIVERTON, IA.—At an election to be held Oct. 12 the proposition to install an electric-lighting system here will be submitted to a vote. Electricity for operating the system will be supplied from either Shenandoah or Hamburg.

WEST BURLINGTON, IA.—The City Council has called a special election for Oct. 29 to vote on the proposition to grant the Burlington Pwr. Co. a 25-year franchise in West Burlington.

GEORGETOWN, KY.—The Kentucky Trac. & Terminal Co. contemplates extending its electric-lighting service to Georgetown and will require additional equipment for substation.

HOPKINSVILLE, KY.—B. H. Kennedy, president of the Owensboro Bridge & Trac. Co., is contemplating the construction of an electric railway to connect Owensboro, Hopkinsville and other places in the western part of Kentucky.

LOUISVILLE, KY.—Surveys are being made by the Louisville & Interurban R. R. Co. for an extension of its suburban railway to Orell and on to West Point, a distance of 6 miles from the present terminal, on the Eighteenth Road.

BALTIMORE, MD.—The Consolidated Gas & El. Co. is extending its transmission lines from Catonsville to Hebbville, a distance of 4 miles.

BALTIMORE, MD.—Plans are being prepared by Lighting Superintendent McCuen for the installation of 1000 additional street lamps next year, principally in alleys and sections where streets are being improved.

AMHERST, MASS.—The Amherst Gas Co. has petitioned the Gas and Electric Light Commission for permission to issue $75,000 in capital stock to pay for improvements recently made for extensions contemplated.

CHICOPEE, MASS.—The Amherst Pwr. Co. has petitioned the Board of Aldermen for permission to erect transmission lines on the Ludlow Road.

GARDNER, MASS.—The Gardner El. Lt. Co. has applied to the Gas and Electric Light Commission for permission to issue 400 shares of additional preferred stock at $105 per share and 400 shares of common stock at $150 per share, the proceeds to be used for paying the cost of a transmission line to South Barre, erecting distributing lines and substations in the towns of Westminster, Hubbardston, and Barre and for improvements recently made and contemplated to the local plant and distributing system in Gardner.

ROYALSTON, MASS.—Options on large tracts of land in Royalston have been taken by parties connected with the Connecticut River Pwr. & Transportation Co. It is proposed to create a large reservoir as an auxiliary to the company's system for generating electricity for commercial purposes.

WEST SPRINGFIELD, MASS.—The Amherst Pwr. Co. will apply to the Selectmen for a franchise to supply electricity in West Springfield.

GRANT, MICH.—The Village Council has entered into a contract with the Grand Rapids-Muskegon Pwr. Co., Grand Rapids, for lighting the streets of the village for a period of 10 years.

PONTIAC, MICH.—The Michigan State Tel. Co. has appropriated $5,000 for the erection of additional toll lines between Pontiac and Detroit.

WYANDOTTE, MICH.—The City Council has authorized the city clerk to advertise for bids for a new electric generating unit for the municipal electric-light plant. This equipment will include either a 250-kw turbine or a condensing engine, together with other necessary equipment.

BRECKENRIDGE, MINN.—A special election will soon be held to vote on the proposition to issue bonds for improvements to the municipal electric-light plant.

CROSBY, MINN.—The Crosby Milling Co., recently incorporated, proposes to operate an electric light and power plant in connection with its milling business. The company is capitalized at $25,000. T. H. Kolbo and Carl E. Gilbertson are among the incorporators.

EAST GRAND FORKS, MINN.—All bids submitted for the substation for the municipal electric-light plant have been rejected by the water and light commission. New bids will soon be asked.

HOPKINS, MINN.—A franchise has been granted to the Consumers' Pwr. Co. to supply electricity for lamps and motors here.

McKINLEY, MINN.—The Village Council has entered into a ten-year contract with the Northern Minnesota Pwr. Co. to supply electricity here.

MINNESOTA, MINN.—Plans are being considered by Emil W. Erick, vice-president and manager of the Citizens' Lt., Ht. & Pwr. Co., Canby, for the installation of a temporary plant here for the winter. It is proposed to erect a transmission line from the plant in Canby in the spring.

PAYNESVILLE, MINN.—The Public Utilities Co., of St. Cloud, has applied for a franchise to supply electricity here, and if it is granted will extend its transmission line to Paynesville.

THIEF RIVER FALLS, MINN.—The Council has engaged an engineer to prepare plans for a municipal telephone system.

PURVIS, MISS.—The Hand-Jordan Lumber Co. has purchased the electric plant of the Purvis Lt. & Pwr. Co., which has been out of commission for the past six months. The company will move the power house from its present site to a location near the planing mill and make preparations to install the street lamps.

VICKSBURG, MISS.—Proposals will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Oct. 30 for extension, remodeling, etc., including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures and approaches of the United States post office and court house at Vicksburg, Miss. Oscar Wenderoth is supervising architect.

HIGGINSVILLE, MO.—Bonds to the amount of $12,000 have been voted for improvements to the municipal electric-light plant and water-works system.

LIBERTY, MO.—The City Council has awarded the Liberty El. Lt. & Pwr. Co. a new contract for lighting the streets of the city for a period of five years. Under the new contract the arc lamps now in use will be replaced with 88 tungsten lamps of 80 cp and 16 lamps of 200 cp.

PALMYRA, MO.—Bonds to the amount of $6,000 have been voted for improvements to the electric-light plant and water-works system.

RICH HILL, MO.—At an election held recently the proposition to issue $15,000 in bonds for improvements to the municipal electric-light plant and water-works system was carried.

ST. LOUIS, MO.—Plans are being considered by James C. Travilla, city street commissioner, for the installation of ornamental street lamps on Locust Street from Jefferson Avenue to Grand Avenue and later to be extended to several other streets.

ST. LOUIS, MO.—Work will soon be started on the construction of a substation for the United Railways Co., to be located on the block bounded by Mississippi, Gravois and Ann Avenues. The building will transform power received from the plant of the Keokuk Pwr. Co. for use on the railways in the south central part of the city. The cost of the substation is estimated at $30,000.

THOMPSON FALLS, MONT.—Surveys have been made for the erection of a transmission line from Thompson Falls to Iron Mountain to supply electricity for the mines from the plant of the Northwestern Devel. Co.

BASSETT, NEB.—At an election held Sept. 20 the proposition to issue bonds for the construction of an electric-light plant and water-works system was carried. W. E. Buckendorf is village clerk.

OMAHA, NEB.—Three propositions for the construction of hydroelectric plants upon the Loup and Platte Rivers in Nebraska are under consideration by the business men of Omaha and Lincoln. The proposed development includes the construction of concrete dams, building long lines of canal for irrigation purposes and the erection of more than 800 miles of transmission lines. It is estimated that more than 300,000 hp can be developed. The site for the proposed plants lies between Genoa and Omaha.

PIERCE, NEB.—The Pierce Milling Co. has purchased the local electric-light plant, and will operate the same.

RULO, NEB.—The installation of an electric-light plant in Rulo is under consideration. The service may be secured from the municipal plant at Falls City.

SHICKLEY, NEB.—The Village Trustees have granted a franchise to John F. Montgomery to construct and operate an electric-light plant here for a period of 25 years. Mr. Montgomery and associates will erect a central generating plant at Edgar and erect transmission lines to the surrounding towns and villages.

TILDEN, NEB.—The Town Council has awarded a contract to the Norfolk Lt. & Pwr. Co., Norfolk, Neb., for the installation of 20 ornamental lamp standards carrying five lamps each.

RENO, NEV.—The Sierra Tel. & Teleg. Co., organized by interests connected with the Nevada-California-Oregon R. R. Co., has applied to the City Council for a franchise in Reno. T. F. Dunaway, president of the above railroad; H. G. Comstock and E. F. Brown are interested.

WINNEMUCCA, NEV.—The Golconda Tel. & Pwr. Co. has applied to the County Commissioners for a franchise to erect telephone, electric-light and power lines in the streets and alleys of Winnemucca, Paradise and National and highways between the towns.

EAST JAFFREY, N. H.—The New Hampshire Wtr. & Lt. Co. has purchased the property of the Troy & Jaffrey El. Lt. Co. The New Hampshire Co. proposes to erect an independent transmission line and will purchase electricity from the Connecticut River Trans. Co., Fitchburg, Mass. This line is to run from the main transmission line in Gardner through Winchendon, connecting with the Winchendon El. Lt. & Pwr. Co., thence to Fitzwilliam; from there the line will continue to Jaffrey, East Jaffrey and Troy.

LEBANON, N. H.—The Grafton County El. Lt. & Pwr. Co. has petitioned the Public Service Commission for authority to issue stock and bonds and for permission to engage in business in the towns of Lebanon and Hanover and also to transmit electricity outside of the State. The company has also asked for permission to purchase the property of the Lebanon El. Lt. & Pwr. Co., Lebanon, and of the Mascoma El. Lt. & Gas Co., of White River Junction, Vt.

HACKETTSTOWN, N. J.—The Hackettstown El. Lt. Co. is planning to erect a transmission line from its plant here to Vienna and Great Meadows, a distance of 4 miles. Charles P. Hankinson is superintendent.

MORRIS PLAINS, N. J.—Bids will be received by the board of hospital managers of the New Jersey State Hospital until Oct. 10 for electric wiring of said hospital. James M. Buckley is president. The George W. Knight Co., Firemen's Building, Newark, N. J., has charge of the engineering work.

NEWARK, N. J.—The Board of Works has passed a resolution asking the Common Council to authorize a bond issue of $650,000 for the purpose of building a municipal garbage incineration and electric generating plant. The cost of the incinerating plant is estimated at $400,000 and that of the electric plant at $250,000. The proposed plant will be located somewhere in the Salt Meadows near the "mosquito line." The garbage plant will have a capacity of 300 tons and the electric plant an output of 750 kw, which will be sufficient to light one-third of the city. It is planned to install a sufficient number of plants to supply electricity to light all the city streets, public buildings, parks and other places under municipal control. The contract between the city and the Public Ser. El. Co. expires Sept. 1, 1913.

FIERRO, N. M.—The Phelps-Dodge interests are planning to install a large electric plant at the copper mines at Fierro.

BINGHAMTON, N. Y.—The Board of County Supervisors has voted to accept the proposition submitted by the city engineer for the installation of ornamental street lamps in the Court House Square. Elecricity for maintaining the lamps will be furnished by the county lighting plant. The cost of the work is estimated at about $2,000.

BROOKLYN, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, corner Park Avenue and Fifty-ninth Street, New York, N. Y., until Oct. 14 for installing, heating and ventilating apparatus and electric generating equipment in the Bushwick High School, on Irving Avenue near Putnam Avenue, Brooklyn. The bids must include a separate proposal on each of the following propositions: (a) plant with Fitzgibbons boilers; (b) plant with Stirling boilers; (c) plant with Milne boilers; (d) ash conveyor, etc., with proposition (b) and (c). Blank forms, plans and specifications may be obtained at the above office and also at the branch office, No. 131 Livingston Street, Brooklyn.

BUFFALO, N. Y.—The contract for electrical work in connection with the construction of the Buffalo State Normal School has been awarded to the Johnson-Fay Electrical Co., Buffalo, N. Y., for $10,268.

BUFFALO, N. Y.—The Board of Aldermen has granted the International Ry. Co. permission to construct and maintain a six-duct conduit with necessary manholes in Fay Street from West Shore Avenue to Walden Avenue and in Walden Avenue from Fay Street to Bailey Avenue.

CARROLL, N. Y.—The Carroll Lt. & Pwr. Co. has applied to the Public Service Commission for approval of its charter and franchises. The company proposes to supply electrical service in Carroll and Kiantone. Electricity for operating the system will be purchased from the Warren & Jamestown St. Ry. Co. Arrangements may also be made to supply electricity in Frewsburg.

CARTHAGE, N. Y.—The Village Board of Trustees has adopted a resolution looking toward the placing of electric wires underground.

CHATHAM, N. Y.—The Chatham El. Lt., Ht. & Pwr. Co. is making preparations to extend its transmission line from Ghent to Philmont to supply electricity in the latter place. The company has secured a contract for lighting the village.

FREEPORT, N. Y.—Bids will be received by the Village Board of Trustees of Freeport, addressed to S. P. Shea, village clerk, until Oct. 18 for two 78-in. by 18-in. horizontal tubular steam boilers and for steam main, boiler-feed piping, blow-offs, and all piping in connection with setting and installation of the two boilers; also for one 22-in. by 30-in. horizontal single-cylinder Corliss engine and one 300-kw, three-phase, 60-cycle, 1100-2200-volt, 150 r.p.m. alternating-current generator and 125-volt belt-driven exciter; also for furnishing and erecting a switchboard in connection with present switchboard. Plans and specifications are on file at the office of the village clerk. James Hanse is president of the board.

LOWVILLE, N. Y.—It is reported that several large capitalists of Lewis and Jefferson Counties have purchased the property at Eagle Falls, on Beaver River, and propose to install a large hydroelectric power plant there. It is proposed to build a large sawmill at once for the purpose of getting out timber for the proposed dam and buildings at the falls. The promoters have secured a right-of-way from Eagle Falls to the Carthage electric plant above Belfort. It is understood that electricity will be supplied to the St. Regis Co., at Deferiet, and 1200 hp to the J. P. Lewis Co., at Beaver Falls.

MIDDLETOWN, N. Y.—Plans have been adopted for the erection of a power house for the Middletown State Hospital, for which an appropriation has been made. It will be necessary to secure an additional appropriation for the equipment of the building.

NEW YORK, N. Y.—The Public Service Commission has executed two contracts with F. L. Cranford, 177 Montague Street, Brooklyn, for the construction of Sections Nos. 1 and 1-A of the Brooklyn subway in Manhattan. Section No. 1 runs from Trinity Place and Morris Street up Trinity Place and Church Street to about Dey Street, Manhattan, and Section No. 1-A from that point up Church Street, Vesey Street and Broadway to Park Place. The contract price for Section No. 1 is $1,222,269 and for Section No. 1-A, $982,740.

NORTH SYRACUSE, N. Y.—A company is being organized by H. Romeyn Smith, of Syracuse; John Hart and C. L. Jackson, of North Syracuse, and J. J. Jackson, of Pittsburgh, Pa., to furnish electricity for lamps and motors here. The company will be known as the North Syracuse Lt. & Pwr. Co. and will secure energy from the power plant of the Syracuse & South Bay El. Ry. Co.

NORTH TONAWANDA, N. Y.—The Tonawanda Pwr. Co. has applied to the Public Service Commission for permission to exercise franchises in the towns of Wheatfield and Pendleton, Niagara County.

PERRY, N. Y.—The Perry Knitting Co. is planning to increase the output of its power plant by 500 hp. It is proposed to construct a new dam in Silver Lake and install additional electric generating machinery and equipment.

ROCHESTER, N. Y.—Plans are being considered for the installation of a new street-lighting system for Main Street. It is expected that State Street will be included. Howard A. Barrows is chairman of the committee.

ROCHESTER, N. Y.—Plans are being considered by the State Engineering Department to contract with the Rochester Ry. & Lt. Co. to furnish electricity to operate and light the guard locks of the barge canal where it crosses the Genesee River in Genesee Valley Park. The company will be called upon to furnish the motors and lamps and maintain same.

SHERBURNE, N. Y.—Arrangements are being made for enlarging the municipal electric-light plant, to cost about $5,000. A new engine and generator will be installed.

WARREN, N. Y.—Plans are being considered for the installation of cluster lamps on Liberty Street between Third Street and Pennsylvania Avenue.

HENDERSONVILLE, N. C.—Plans are being prepared by the Laurel St. Ry. Co. to equip its line in Hendersonville, 2½ miles long, for electrical operation.

WHITNEY, N. C.—Contracts have been awarded by the Southern Aluminum Co. to the General El. Co. for electrical equipment for its power plant at Whitney, to cost about $400,000, which will supply electricity for the extensive aluminum works to be established here. The equipment consists of seven 5000-kw and two 2500-kw, 250-volt alternating-current generators with necessary switchboard and control apparatus. Electrical furnaces will be used in the reduction of alumina to pure aluminum and the entire output of the hydroelectric plant will be utilized. Plans are being prepared for the construction of a second plant to develop 35,000 hp later.

WILLISTON, N. D.—The Council is making arrangements to secure electricity from the government to operate the municipal electric-light plant.

WILTON, N. D.—The City Council is negotiating with the Washburn Lignite Coal Co. with a view of making extensions to the street-lighting system.

ALLIANCE, OHIO.—The City Council has adopted a resolution to submit the proposition to issue $15,000 in bonds to establish a municipal electric-light plant here to the voters at the November election.

AKRON, OHIO.—The ordinance granting the Northern Ohio Trac. & Lt. Co. a franchise to supply electricity in Akron and a contract for street-lighting has been signed by Mayor Rockwell.

BEACH CITY, OHIO.—The Public Service Commission has granted Mrs. Peter Shister permission to purchase the local electric-light plant. The purchase price is said to be $8,000.

CINCINNATI, OHIO.—The Public Service Commission has granted the Ohio Trac. Co. permision to issue $750,000, to be sold at 98 to provide funds for making extensions, acquiring property and completing work already planned for the Cincinnati Trac. Co.

EAST LIVERPOOL, OHIO.—The Public Service Commission has granted the Ohio River Ry. Co. permission to issue $750,000 in bonds to cover the cost of extending its railway between Wellsville and East Liverpool.

MARYSVILLE, OHIO.—Preparations are being made by the Union County Tel. Co., Marysville, to take over the property and business of the Central Union Tel. Co. in this place. Improvements and extensions costing about $18,000 will be made to the system.

MIDDLETOWN, OHIO.—The Eastern Ltg. & Pwr. Co. has purchased

the property of the Middletown Gas & El. Lt. Co. Extensions and improvements will be made to the plant. L. C. Anderson is manager.

MOUNT BLANCHARD, OHIO.—The City Council is contemplating the installation of a municipal electric-light plant, to cost from $5,000 to $6,000.

MOUNT VERNON, OHIO.—The Mount Vernon Ry. Co. has applied to the Public Service Commission for permission to purchase the street-railway property of the Mount Vernon El. Co., which it is operating under a lease. The price has been placed at $50,000. The company has also petitioned for authority to issue $100,000 in bonds, the proceeds of the remainder, after payment for the railway, to be used for improvements and extensions to the property.

ORRVILLE, OHIO.—The Massillon El. & Gas Co., Massillon, has applied to the Public Service Commission for permission to purchase the property of the Orrville Lt., Ht. & Pwr Co. for $20,000. The Massillon company proposes to consolidate the two systems and operate them under one head.

HOOKER, OKLA.—The Council has awarded the contract for construction of a municipal electric-light plant and water-works system to Kennedy & Fleming, engineers, Oklahoma City. The cost is estimated at $22,000.

EUGENE, ORE.—The electric railway of the Oregon El. Ry. Co. from Portland to Eugene is nearly completed. The road will be extended to Medford in the near future.

FLORENCE, ORE.—The Florence El. Co. contemplates enlarging its plant soon to enable it to supply electricity for range and harbor lamps.

LA GRANDE, ORE.—Work will soon begin on the installation of cluster street lamps in the business section.

NEHALEM, ORE.—Application has been made to the Council by Charles Foster for a 30-year franchise to supply electricity here.

PORTLAND, ORE.—The Portland Ry. Lt. & Pwr. Co. is planning to begin work on the Mount Tabor branch in the near future.

PANAMA.—Proposals will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until Oct. 12 for furnishing structural steel for hydroelectric power station. Blanks and general information relating to this circular (No. 736) may be obtained from the above office or at the offices of the assistant purchasing agents, 24 State Street, New York, N. Y., and 614 Whitney-Central Building, New Orleans, La. Major F. C. Boggs is general purchasing officer.

PANAMA.—Proposals will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until Oct. 30 for furnishing necessary equipment for the new Colon water works, including regulators, controllers, air compressors, air hoists, etc., and the necessary multi-stage, electrically driven fire pumps, transformers, pump-station piping, traveling crane and miscellaneous details for pumping station. Blanks and general information relating to this circular (No. 739) may be obtained at the above office or at the offices of the assistant purchasing agents, 24 State Street, New York; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Major F. C. Boggs is purchasing agent.

DALLASTOWN, PA.—The plant and holdings of the York & Windsor El. Lt. Co. have been taken over by interests affiliated with the Edison El. Lt. Co., of York. It is expected that improvements will be made to the plant and service. John B. Landers has been elected president and S. H. Ludwig secretary and treasurer.

IRWIN, PA.—Plans are being considered for the installation of an ornamental street-lighting system in Irwin.

PITTSBURGH, PA.—The West Penn Trac. & Wtr. Co. has commenced work on several important additions to its railway system and is also enlarging its substation and carhouses at various points. Franchises and rights-of-way have been secured and contracts let for an electric railway to connect Latrobe with the main line between Connellsville and Greenburg at the Hecla Works on the Frick Coal & Coke Co. Surveys are also being made for a railway to extend from Hunker to West Newton, and another from West Newton to Scott Haven, a total of about 15 miles.

SHARON, PA.—The Shenango Valley El. Lt. Co. has submitted a proposition to the City Council offering to supply street arc lamps at $55 each per year under a five-year contract and $48 per lamp per year on a ten-year contract, the city to use any number of lamps that may be desirable. At present 149 lamps are in use. The city is contemplating the installation of a municipal electric-light plant.

SUNBURY, PA.—Work has begun on construction of the power house for the Odd Fellows' Orphanage, near Sunbury. The plant will supply electricity for lamps, heat and motors for the school buildings and to pump water for the institution.

PAWTUCKET, R. I.—Plans have been prepared by McClintock & Craig, Springfield, Mass., for the erection of a power plant for D. Gough & Son, Pawtucket.

ABERDEEN, S. D.—The Dakota Central Tel. Co. contemplates improvements and extensions to its system in South Dakota and southern North Dakota which involve an expenditure of about $50,000.

CANASTOTA, S. D.—Plans have been prepared for the installation of an electric-light system here.

LESTERVILLE, S. D.—The installation of an electric-light plant here is under consideration.

DRESDEN, TENN.—The Dresden Commercial Club is promoting a movement for the installation of an electric-light plant and water-works system for the town.

JOHNSON CITY, TENN.—Plans are being prepared for the installation of an ornamental street-lighting system in the business district.

FORT WORTH, TEX.—The city commissioners and the Park Board are contemplating installing arc lamps in the parks to replace the incandescent lamps now in use.

GAINESVILLE, TEX.—The Texas Utilities Co., of Dallas, is contemplating the construction of an interurban electric railway between Gainesville and Sherman, a distance of about 30 miles.

GREENVILLE, TEX.—Arrangements are being made for the installation of an electric-light plant at Wesley College to supply electricity for lighting the college buildings and dormitories.

GREENVILLE, TEX.—It is reported that steel rails have been purchased for the first 12 miles of the Anna, Blue Ridge & Greenville Interurban Railway. The entire length of the road will be 32 miles. A. R. Nichols is promoter.

HALLETTSVILLE, TEX.—The City Council is planning to install new equipment in the municipal electric-light and water plants.

HOUSTON, TEX.—Extensive improvements and extensions are contemplated by the Houston El. Co. to its system this year, which will involve an expenditure of about $1,000,000. David Daly is manager.

LONGVIEW, TEX.—Preliminary arrangements are being made for the construction of an interurban electric railway to extend from Longview, Tex., to Shreveport, La., a distance of about 65 miles. A branch line will probably be built to Jefferson, Tex. T. C. Morgan, R. G. Brown, G. A. Kelly and W. K. Eckman, all of Longview, are interesetd.

NEW BRAUNFELS, TEX.—The City Council has awarded the Midland Engineering & Constr. Co. the contract for erecting pumping station at head of river to furnish water supply at $52,447. The contract includes pump, pipe line to city reservoir, 280-hp engine and equipment for electric-light plant.

SHINER, TEX.—The United Pwr. Devel. Co. would like to receive estimates on electrical machinery for water-power plant, including turbines, wire, poles, etc. William Green, Shiner, is president.

WICHITA FALLS, TEX.—Plans are being considered for the construction of an electric railway from Wichita Falls to Electra and from Electra to Burkburnett, a distance of about 30 miles. A syndicate of Tulsa, Okla., capitalists are interested.

WICHITA FALLS, TEX.—Extensive improvements are contemplated by the Strickland interests within the next few months to water and light systems recently acquired by them, which will involve an expenditure of about $100,000, and will include the erection of new lighting circuits so as to give three circuits instead of one, changes in the lighting system in the downtown district and extensions to water mains.

SALT LAKE CITY, UTAH.—Surveys are being made for a proposed electric interurban railway between Salt Lake City and Payson, a distance of 62 miles. The cost of the road is estimated at $2,000,000. John MacGinness, a Montana banker, and Thaddeus S. Lane, of Spokane, Wash., are interested in the project.

LYNCHBURG, VA.—The Chamber of Commerce would like to receive estimates on the installation of sixty-eight five-lamp electroliers, equipped with tungsten lamps. Specifications may be obtained on application to E. H. Mayfield, business secretary.

NEWPORT NEWS, VA.—Plans are being considered by the special lighting committee for the installation of a new street-lighting system. The plans call for luminous-arc lamps and "Mazda" lamps in the business district.

CONCRETE, WASH.—The city will soon begin work on the installation of a fire-alarm system.

EATONVILLE, WASH.—The Forestry Service is planning to build more than 40 miles of trails and telephone lines in the Rainer National Forest, involving an expenditure of about $5,000.

ELLENSBURG, WASH.—Tentative plans have been prepared for the construction of a large hydroelectric power plant on the Columbia River at Priest Rapids to develop from 75,000 hp to 100,000 hp. The plans call for the construction of a canal 9 miles long, 300 ft. wide at the top and 150 ft. at the bottom, with a depth of 45 ft. Electricity generated at the plant will be distributed in the towns along the river for lamps and motors. The cost of the project is estimated at $12,000,000. Oscar Voightlander is interested.

EVERETT, WASH.—The County Commissioners have granted the Sultan El. Co. a 25-year franchise to erect a transmission line along the E. M. Taylor and Monroe-Sultan roads.

LYMAN, WASH.—The Skagit River & Tel. & Teleg. Co. has been granted a franchise to operate in Lyman.

LYMAN, WASH.—The Pacific Northwestern Trac. Co. has been granted a franchise to extend its system to Lyman.

GREEN BAY, WIS.—The Wisconsin Securities Co. has purchased for the use of the Green Bay Gas & El. Co. a site on the Fox and East Rivers, near the gas works. The company proposes to build a coal dock on the rivers and to build on other property as business develops.

SPRING VALLEY, WIS.—The Chippewa Valley Lt. & Pwr. Co., Eau Claire, it is said, will take over the property of the Spring Valley

Lt. & Pwr. Co. and extend its transmission lines to Spring Valley. The system will be changed from direct-current, 220 volts, to alternating-current, 110 volts.

VERNON, B. C., CAN.—The Okanogan Tel. Co. is contemplating extensive improvements and extensions to its system, involving an expenditure of about $200,000.

ST. JOHN, N. B., CAN.—The St. John St. Ry. Co. is extending its transmission lines to East St. John to supply electricity for lamps. The company will begin work at once on the extension of its street railway to that district.

COBALT, ONT., CAN.—The British Canadian Pwr. Co. has been absorbed by the Northern Ontario Lt. & Pwr. Co. J. H. Black is manager of the Northern Ontario company.

GODERICH, ONT., CAN.—The Hydro-Electric Power Commission has submitted a proposition to the Town Council offering to develop power on the Maitland River if 1500 hp is guaranteed and to sell it at $27 per hp. In the meantime if the power is wanted at once, it will erect a transmission line from Seaforth and supply it at the same price.

HAMILTON, ONT., CAN.—Steps have been taken by the City Council to compel the local electric-light, telephone and telegraph companies to place their wires underground in the business district.

TORONTO, ONT., CAN.—Electricity for lighting York Township in this vicinity will be supplied by the Hydro-Electric Power Commission. Work will begin at once on installation of the system.

WELLAND, ONT., CAN.—The Welland Elecl. Co. has applied to the City Council for permission to erect transmission lines on Heilems Avenue.

WINDSOR, ONT., CAN.—The Edison Illg. Co. of Detroit, Mich., has commenced work on the construction of a large electric plant on the river front in Sandwich, Ont., which when completed will probably supply electricity for lamps and motors in the towns of Essex, Leamington and Amherstburg. These towns at present are supplied with electrical service by small local plants.

New Industrial Companies

THE ALYEA MANUFACTURNG COMPANY, of Chicago, Ill., has been incorporated by Charles B. Alyea, Graham Van Ness and Preston Clark. The company is capitalized at $10,000 and proposes to manufacture and deal in machinery, electrical devices and appliances.

THE BLANDING ELECTRICAL SUPPLY COMPANY, of Binghamton, N. Y., has been granted a charter with a capital stock of $10,000. The incorporators are: Harold T. Blanding, J. A. Blanding and E. L. Ackerman, all of Binghamton.

THE DYER FLAMING ARC COMPANY, of Philadelphia, Pa., has filed articles of incorporation under the laws of the State of Delaware with a capital stock of $10,000 to manufacture and deal in motors, dynamos and other electrical machinery.

THE ELECTRIC SERVICE COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $2,500 to do a general electrical work and an electrical engineering business. The incorporators are: L. V. Murphy, Ambrose McLaughlin and George C. Schnackle.

THE KOSMARK ELECTRICAL COMPANY, of Jersey City, N. J., has been incorporated by J. R. Cubit, of Eatontown, N. J.; W. Kosinski, 39 Stevens Avenue, and J. R. Mack, 530 Garfield Avenue, both of Jersey City. The company is capitalized at $10,000 and proposes to manufacture electrical horns and signals for automobiles, electric batteries, etc.

THE LAMAY MANUFACTURING COMPANY, of Rochester, N. Y., has been incorporated with a capital stock of $25,000 to manufacture and sell motors, engines, machines, etc. The incorporators are: A. B. Headley, P. E. Tucker and A. C. Lamay, of Rochester.

THE RETENBER ELECTRIC COMPANY, of Logansport, Ind., has been incorporated with a capital stock of $50,000 by E. A. Retenber, J. F. Digan and J. E. Long. The company proposes to manufacture all kinds of electrical devices, machinery, implements, etc.

THE SUNSET SIGN COMPANY, of Newark, N. J., has been incorporated with a capital stock of $125,000 by C. B. Herman, J. F. Marion and A. McMahon, of Jersey City. The company proposes to manufacture electrical signs, etc.

THE WIZARD SIGN MANUFACTURING COMPANY, of Chicago, Ill., has been incorporated by W. H. Devenish, H. J. Meyers and J. Warner, of Chicago, Ill. The company is capitalized at $25,000 and proposes to manufacture advertising devices.

New Incorporations

BENTONVILLE, ARK.—The Northwest Arkansas Ry. Co. has been incorporated with a capital stock of $648,000 to build an electric railway to connect Bentonville, Rogers, Springdale, Cave City and Pea Ridge, a distance of 36 miles.

CENTRALIA, ILL.—The Centralia Trac. Co. has been granted a charter to construct a railway from Broadway in Centralia, to the new Illinois Central railroad yards in Washington County. The company is capitalized at $25,000 and the directors are: John Langenfield, Max Prill, Martin Beck, John Kihnlein and Charles C. Baldwin, all of Centralia.

PAYSON, ILL.—The Payson El. Lt. & Pwr. Co. has filed articles of incorporation with a capital stock of $5,000 to operate an electric light and power plant. The incorporators are: William K. Elliott, L. K. Seymour, H. F. Scarborough and G. W. L. Baker.

SPRINGFIELD, ILL.—The Mississippi Valley Trac. Co. has been incorporated by George M. Skelley, Col. W. S. Campbell, C. F. Smith, of Springfield; Edward C. Creager, of Kent, Ohio, and Johnson M. Creager, of Youngstown, Ohio. The company is capitalized at $2,500 and proposes to construct an interurban railway from Springfield to Quincy.

INDIANAPOLIS, IND.—The Merchants' Utility Co. has been incorporated with a capital stock of $4,000,000 to construct electric interurban railways and to distribute electricity for lamps, heat and motors. The directors are: Edward L. McKee, C. M. Polen, Henry H. Hornbrook, Albert P. Smith and Walter S. Gloss.

MICHIGAN CITY, IND.—The Michigan City, Lakeside & St. Joe El. Ry. Co., has applied for a charter to construct an electric railway from St. Joseph to New Buffalo, thence in a southwesterly direction to the Indiana State line to connect with an extension to Michigan City. The proposed railway will be 36 miles in length. The company is capitalized at $750,000 and the directors are: G. C. Marsh, P. C. Cramer, Otto Egloff, all of Chicago, Ill.; Eugene Sheed and H. Bussan, of New Buffalo, Mich., and J. H. MacMillan, of Lagrange, Ill.

VALPARAISO, IND.—The Citizens' Mutual Lt., Ht. & Pwr. Co. has been incorporated with a capital stock of $100,000. The directors are: Charles E. Foster, John W. Sieb and James H. McGill and others.

PETERSON, IA.—The Peterson Pwr. & Milling Co. has been incorporated with a capital stock of $40,000 to supply light and heat and do a general milling business. The directors are: A. M. Jones, D. McMillan, A. O. Anderson, W. E. Landsberg and E. L. Mantor.

KANSAS CITY, MO.—The Heath El. Co. has been chartered with a capital stock of $2,500 by H. L. Heath, G. G. Steele and H. G. Woodruff.

BROOKLYN, N. Y.—The New York Municipal Railway Corpn has been incorporated with a capital stock of $2,000,000 in the interests of the Brooklyn Rapid Transit Co., to carry out the company's agreement with the city for the joint construction of certain new rapid-transit lines embraced in the dual system. The directors are: Anthony N. Brady, J. Horace Harding, Walter G. Oakman, John T. Greier, James C. Brady and George W. Davidson, of New York; Timothy S. Williams, Charles A. Brady, Clinton D. Burdick, John W. Weber, George D. Yeomans, John Englis and Arthur K. Woods, of Brooklyn.

SPENCER, N. Y.—The Seely El. Co. has been incorporated with a capital stock of $15,000 to supply electricity for lamps, heat and motors in Spencer. The incorporators are: Mary E. Seely, Charles A. Seely and Hart I. Seely, all of Spencer.

NAZARETH, PA.—Articles of incorporation have been filed with the State Department by the Pennsylvania Utilities Co. with a capital stock of $40,000. The company has taken over and merged the following companies: Slate Belt El., Ht. & Pwr. Co., Jay, Adams, Webster, Calhoun, Quincy and Jackson Pwr. Companies, which were chartered to operate in Northampton and Monroe Counties.

Trade Publications

SYNCHRONISM INDICATOR.—The General Electric Company has recently issued Bulletin No. 4975, which is a revision of a former bulletin, No. 4613, devoted to the synchronism indicator.

CIRCUIT-BREAKERS.—The Condit Electrical Manufacturing Company, 76 Batterymarch Street, Boston, Mass., is distributing its advance catalog on the Big "C" line of oil-break and carbon-break circuit-breakers, which supersedes all previous price lists.

POWER TRANSFORMERS.—Bulletin No. 154, recently brought out by the Crocker-Wheeler Company, Ampere, N. J., is devoted to its oil-insulated, self-cooled and water-cooled transformers, 50 kva to 5000 kva. A fully illustrated description of this apparatus is given.

LAMP TESTING.—The engineering department of the National Electric Lamp Association, Cleveland, Ohio, tells a litle "story" about itself, its efforts, accomplishments and aims in Bulletin 2A, recently published. Illustrations of the various sections of this department brighten the pages of text.

POLYPHASE INDUCTION MOTORS.—The Mechanical Appliance Company, Milwaukee, Wis., has just brought out a new thirty-page catalog describing its type K polyphase induction motors. This illustrated booklet gives all the details of construction, a list of the standard sizes, with speed and horse-power output, and a description of the operating characteristics.

MACHINE TOOLS.—The Newton Machine Tool Works, Inc., Philadelphia, Pa., have recently published Catalog No. 47, which describes in detail the machine tools manufactured by this company. It contains several excellent full-page illustrations of boring, drilling and milling machines and also numerous smaller views. The catalog contains much of interest to the manufacturers of electrical apparatus.

ROTARY CONVERTER.—Leaflet No. 2494 issued by the Westinghouse Electric & Manufacturing Company fully illustrates and describes the Westinghouse synchronous-booster rotary converter. This machine consists of a standard rotary converter in combination with a revolving-armature alternating-current generator mounted on the same shaft with and having the same number of poles as the converter, by means of which the direct-current voltage may be varied.

WOOD-PRESERVING MACHINERY.—The Power & Mining Machinery Company, 115 Broadway, New York, has issued Bulletin P-35, which contains interesting historical information on wood preservation, treating especially the period which began with the introduction of Sir William Burnett's process in 1838 and subsequent developments. The general arrangement of a creosoting plant is presented, with illustrations of the machinery employed and miscellaneous information.

MAP OF CROCKER-WHEELER DISTRICT OFFICES.—The Crocker-Wheeler Company, Ampere, N. J., is sending out as part of a letter an outline map of the United States, on which are indicated, by means of black lines radiating from one large business center to another, the cities in which the company maintains district and sales offices. The object of this is to make it plain that any kind of electrical machinery may be secured without delay from any of these district offices.

HIGH-TENSION PANELS.—A booklet distributed by Messrs. Ferranti, Ltd., of England, describes their totally inclosed high-tension, iron-clad panels and shows various safety interlocks coupled to the switches and door. It also describes a typical panel and gives details of additional equipment that may be required. Further descriptive matter deals with the upper and lower doors, the switch operations and the busbar, isolating switch, transformer, oil switch and other compartments.

ELECTRIC DRILLS AND GRINDERS.—The Standard Electric Tool Company, Cincinnati, Ohio, devotes Bulletin D-6 to its "Standard" high-power, ball-bearing electric drills and Bulletin G-5 to its small portable electric grinders. Both bulletins were recently issued, and these tools are now being placed on the market. It is claimed that they will withstand the most severe continual service; that their mechanical construction is strong, rigid and simple and that they are built for high power.

STEAM AND GAS ENGINES.—An attractive, well-illustrated forty-eight-page catalog is being distributed by the Mesta Machine Company, West Homestead, Pa., which contains a brief description of its plant and product. Among other machinery manufactured by this company are gas and steam engines for power plants, power-transmitting machinery, air compressors and condensers, rolling mills and blast furnaces. Some recent installations of Mesta gas engines in power stations are described.

TUNGSTEN LAMPS.—The Edison Lamp Department of the General Electric Company, through its general sales office at Harrison, N. J., has recently distributed a lithographed chart, size 44 in. by 28 in., ready for hanging, illustrating eighteen different types of tungsten-filament lamps in actual size. The poster is brilliantly colored and produces a very striking effect. Under each lamp appears its own specification. The chart makes a ready pictorial reference for present and intending purchasers.

ELECTRIC SUPPLIES.—A large general catalog—No. 9—size 8 in. by 11 in., has recently been issued by the Electrical Manufacturing Company, 926 Lafayette Street, New Orleans, La. It has sixty pages, devoted to the illustrations, descriptions and specifications of panels, cabinets, service boxes, switchboards, electric signs, theater equipments, knife switches, electric incubators and hovers, and other miscellaneous devices. The section relating to self-regulating electric incubators, hovers and brooders is very complete.

STEEL AND TIN PLATE REFERENCE BOOK.—The American Sheet & Tin Plate Company, Pittsburgh, Pa., has issued a new and revised edition of its "Reference Book," and has combined in it some interesting history of the industry, specific data and numerous tables and calculations. A good index to the contents and another to tables, gages, weights, etc., lend value to the little book. It contains 152 pages, a few of which are blank for memoranda, and is bound in leather, vest-pocket size, with full gilt edges. It is copyrighted and the price is $1.

INSULATING MATERIAL.—Five serial bulletins on insulating material are being sent out by the Mica Insulator Company, 68 Church Street, New York, which are printed separately and placed in a special binder. They are Nos. 78, 79, 80, 81 and 82. This company has been manufacturing insulating material for the last twenty years. The latest catalog contains information on its various products, including vulcanized fiber sheets, tubes and rods, untreated papers, sleevings, friction and splicing tapes, shellac, etc., and will be of interest to engineers and purchasing agents.

SWITCHBOARD INSTRUMENTS.—The Westinghouse Electric & Manufacturing Company has just issued a series of descriptive leaflets (Nos. 2465 to 2473) illustrating its new line of switchboard indicating meters. On each leaflet is a full-size fac-simile of the meter dial, the purpose of which is to present a correct idea of the actual appearance of the meter when installed. By mounting one of these leaflets on the wall an accurate idea of the readability of the meter from any distance or position may be gained.

MANILA ROPE.—The C. W. Hunt Company, West New Brighton, N. Y., is distributing its Catalog 12-8 on manila rope for transmission and hoisting purposes. This fifty-page illustrated pamphlet is a brief treatise for engineers on the use of ropes for power transmission, together with formulas, tables and data useful in mill engineering. It also includes valuable data on different methods of splicing transmission rope. Page 46 gives a condensed bibliography on rope-driving, which includes only recognized authorities.

CONTROLLERS.—The Reliance Electric & Engineering Company, Cleveland, Ohio, in its recently issued Bulletin No. 7010 illustrates and describes its automatic starting control apparatus for motor-driven machinery. This company has developed a complete system of automatic starting control for practically all types of machine tool drives and claims that it was the first motor manufacturer to accomplish this, which it did after thoroughly demonstrating the practical merit and reliability of automatic starters for such service.

DIFFERENTIAL RECORDING GAGES.—Bulletin No. 67, recently issued by the Industrial Instrument Company, Foxboro, Mass., deals with its differential recording gage. This instrument has been placed on the market to meet the increasing demand for an instrument to record satisfactorily the difference between two existing pressures. This differential recorder does not differ in appearance from the regular industrial recorder, having a round case which is moisture-proof, dust-proof and flume-proof. These instruments are especially adapted for use with Venturi meters and Pitot tubes to record the velocity and volume of liquids and gases flowing through mains, also to record height of liquids in vessels under pressure, such as the height of water in steam boilers. The bulletin contains records from two different installations as examples of results obtained.

Business Notes

THE MACHEN & MAYER ELECTRICAL MANUFACTURING COMPANY, Philadelphia, Pa., has moved its factory from Seventh and Vine Streets to Twenty-first Street and Fairmount Avenue.

THE PACIFIC ELECTRIC HEATING COMPANY, Ontario, Cal., has changed its name to the Hotpoint Electric Heating Company in order to indicate the character of its output and remove the implication of limitation in territory covered.

LOCKWOOD, GREENE & COMPANY, architects and engineers, of Boston, have opened a Chicago office in the First National Bank Building, which will be in charge of Mr. Theodore A. Burgen, who will look after the firm's business in the new territory.

THE CRAVENS ELECTRIC COMPANY has moved its offices as designing and manufacturing engineers from the Commercial National Bank Building to 12 South Jefferson Street, Chicago, Ill. A fully equipped shop will be maintained at the same address.

THE UNION LIGHT & SUPPLY COMPANY, of Chicago, which is the sole American importer and distributor of wire-drawn "Just" tungsten lamps, has opened an office in the Hudson Terminal, 50 Church Street, New York City, where Mr. J. F. A. Comstedt, president of the company, will maintain his headquarters.

THE KERR TURBINE COMPANY, Wellsville, N. Y., has opened a district office in Pittsburgh, at 2137 Oliver Building. The office will be in charge of Mr. R. M. Rush, formerly with the Dravo-Doyle Company. With Mr. Rush will be associated Mr. F. B. Allen, formerly of the Cleveland office of the Cooper-Hewitt Electric Company.

THE PURE CARBON COMPANY, Wellsville, N. Y., is making announcement of the establishment of an engineering department for the aid of engineers and others interested in carbon brushes of any manufacture, and the services of these experienced engineers are placed at the service of all users of electrical machines and carbon brushes.

MR. H. E. RICE, who for a number of years has been connected with the Atwater-Kent Manufacturing Works, of Philadelphia, as sales manager, has resigned from that company and has accepted a position as general manager of sales of the Schoen-Jackson Company, of Media, Pa. The Schoen-Jackson Company, which was formerly a prominent manufacturer of pressed-steel cars and car wheels and which now manufactures flexible metallic tubing, is about to place on the market a new carburetor for automobile use.

THE CROCKER-WHEELER COMPANY, Ampere, N. J., in a recently published illustrated thirty-two-page brochure, gives an interesting history of its home city and of the company and its personnel. Some excellent photographs embellish this attractive publication and give an idea of the extensive works developed from modest beginnings. Biographies and portraits of Dr. Wheeler and Professor Crocker lend additional interest to this publication. A financial statement for the year ended Dec. 31, 1911, is also included. The front cover contains a reproduction in colors of the bronze tablet which is set in the wall of the waiting room at Ampere, in honor of André Marie Ampère, whose name is used throughout the world to designate the unit of electric current.

WESTERN ELECTRIC COMPANY.—As the result of taking over the business of the Cleveland Electrical Supply Company, the Western Electric Company has increased its family of distributing houses. It retains the entire personnel of the supply company which it supersedes, with the exception of Mr. R. F. La Ganke, vice-president and manager, who is retiring from active business. Mr. H. A. Speh, of the Buffalo house, succeeds to the post of manager. Mr. Louis Griesser, sales manager, has been twenty years in the electrical business at Cleveland. The Cleveland house has in Mrs. M. L. Hausman the only saleswoman in the company's employ. It is probable that a warehouse will be established in the near future for the service of the Central Union Telephone in Ohio. A telephone sales department has also been organized under the supervision of Mr. F. E. Triebner, formerly of the electric company's Nashville office.

Directory of Electrical Associations, Societies, Etc.

ALABAMA LIGHT & TRACTION ASSOCIATION. Secretary-Treasurer, Geo. S. Emery, 11 N. Royal St., Mobile, Ala. Annual convention, Birmingham, November, 1912.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Secretary, L. O. Howard, Smithsonian Institution, Washington, D. C.

AMERICAN ELECTRIC RAILWAY ACCOUNTANTS' ASSOCIATION. Secretary, H. E. Weeks, Davenport, Ia. Annual meeting, Chicago, Oct. 7-11, 1912.

AMERICAN ELECTRIC RAILWAY ASSOCIATION. Secretary, H. C. Donecker, 29 West 39th St., New York. Convention, Chicago, Oct. 7-11, 1912.

AMERICAN ELECTRIC RAILWAY ENGINEERING ASSOCIATION. Secretary, Norman Litchfield, Interborough Rapid Transit Company, New York.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards. Lehigh University, South Bethlehem, Pa.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION. Secretary, Dr. J. Willard Travell, 27 East 11th St., New York.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS. Secretary-Treasurer, Eugene W. Stern, 103 Park Ave., New York City. The Council meets the first Friday of every month.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, F. L. Hutchinson, 29 West 39th St., New York. Meeting, second Friday of each month, October-May.

AMERICAN PHYSICAL SOCIETY. Secretary, Ernest Merritt, Cornell University, Ithaca, N. Y. Annual meeting, Cleveland, Ohio, jointly with the American Association for the Advancement of Science, December, 1912.

AMERICAN WATER WORKS ASSOCIATION. Secretary, J. M. Diven, 271 River St., Troy, N. Y.

ARKANSAS ASSOCIATION PUBLIC UTILITY OPERATORS. Secretary, W. J. Tharp, Little Rock, Ark.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, H. T. Edgar, Seattle, Wash.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, James Farrington, Steubenville, Ohio.

ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS. Secretary-Treasurer, Jos. A. Andreucetti, Chicago & Northwestern Railway, Chicago. Annual convention, Auditorium Hotel, Chicago, Oct. 21-26, 1912.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, 112 West Adams St., Chicago. Annual meeting, St. Louis, Mo., May 20, 1913.

COLORADO ELECTRIC CLUB. Secretary, C. F. Oehlmann. Meets every Thursday at Albany Hotel, Denver, Colo.

COLORADO ELECTRIC LIGHT, POWER & RAILWAY ASSOCIATION. Secretary, Thomas F. Kennedy, 900 15th St., Denver, Colo.

ELECTRIC CLUB OF CHICAGO. Secretary, W. M. Connelly, 1417 Monadnock Block, Chicago. Meets every Thursday noon at Hotel Sherman.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, Geo. W. Russell, Jr., 25 West 42d St., New York. Annual meeting, Syracuse, N. Y., Jan. 21, 1913.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, Ernest S. Cowie, 1613 Grand Ave., Kansas City, Mo.

ELECTRICAL CONTRACTORS' ASSOCIATION OF WISCONSIN. Secretary, Albert Petermann, Milwaukee, Wis.

ELECTRICAL CREDIT ASSOCIATION OF CHICAGO. Secretary, Frederick P. Vose, Marquette Building, Chicago.

ELECTRICAL CREDIT ASSOCIATION OF PHILADELPHIA. Secretary-Treasurer, John W. Crum, 1324 Land Title Building, Philadelphia, Pa. Executive Committee meets second and fourth Thursday of each month.

ELECTRICAL SALESMEN'S ASSOCIATION. Secretary, Francis Raymond, 125 Michigan Ave., Chicago. Annual meeting, Chicago, January each year.

ELECTRICAL SUPPLY JOBBERS' ASSOCIATION. Secretary, Franklin Overbagh, 411 South Clinton St., Chicago, Ill. Next quarterly meeting, Hot Springs, Va., November 13-15, 1912.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Can.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliot, Harding Building, 34 Ellis St., San Francisco, Cal Meeting, San Francisco, second Thursday of each month.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA. Ass't Secretary, Harvey Robinson, 124 West 42nd Street, New York. Meeting, fourth Tuesday of each month. Convention, Boston, Oct. 8-9, 1912.

ELECTRIC VEHICLE ASSOCIATION OF AMERICA, NEW ENGLAND SECTION. Secretary, W. E. Holmes, 46 Blackstone St., Boston, Mass. Meetings monthly upon notice.

EMPIRE STATE GAS & ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, Engineering Societies Building, 29 West 39th St., New York.

FLORIDA ELECTRIC LIGHT & POWER ASSOCIATION. Secretary, H. C. Adams, West Palm Beach, Fla.

GAS, ELECTRIC & STREET RAILWAY ASSOCIATION OF OKLAHOMA. Secretary-Treasurer, Prof. H. V. Bozell, Norman, Okla.

ILLINOIS STATE ELECTRICAL ASSOCIATION. Secretary, H. E. Chubbuck, Peoria, Ill.

ILLUMINATING ENGINEERING SOCIETY. General Secretary, P. S. Millar, Engineering Societies Building, 29 West 39th St., New York. Sections in New York, New England, Philadelphia, Chicago and Pittsburgh.

INDEPENDENT ELECTRICAL CONTRACTORS' ASSOCIATION OF GREATER NEW YORK. Secretary, A. Newburger, 1153 Myrtle Ave., Brooklyn, N. Y. Meetings second and fourth Wednesdays, New Grand Hotel, New York.

INDIANA ELECTRIC LIGHT ASSOCIATION. Secretary, J. V. Zartman, 120 So. Meridian St., Indianapolis, Ind. Annual meeting, Indianapolis, Oct. 16-17, 1912.

INSTITUTE OF RADIO ENGINEERS. Secretary, E. J. Simon, 81 New St., New York. Meeting, first Monday of each month.

INTERNATIONAL ASSOCIATION FOR TESTING MATERIALS. Secretary, H. J. F. Porter, 29 West 39th St., New York.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, C. R. George, Houston, Tex.

INTERNATIONAL COMBUSTION ENGINEERS' ASSOCIATION. President, Charles Kratsch, 416 W. Indiana St., Chicago. Meeting, second Friday of each month at Lewis Institute.

INTERNATIONAL ELECTRICAL CONGRESS. Secretary, J. A. Barus. Exposition Bldg., San Francisco, Cal. San Francisco, 1915.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). General Secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., England. Next meeting at Berlin in 1913.

IOWA ELECTRICAL ASSOCIATION. Affiliated with N. E. L. A. Annual convention, Waterloo, April 23-24, 1913. Secretary, A. W. Zahm, Mason City, Ia.

IOWA STREET & INTERURBAN RAILWAY ASSOCIATION. Secretary, H. E. Weeks, Davenport, Ia. Annual meeting, April, 1913, Waterloo, Ia.

KANSAS GAS, WATER, ELECTRIC LIGHT & STREET RAILWAY ASSOCIATION. Secretary, James D. Nicholson, Newton, Kan. Annual meeting, Manhattan, Kan., Oct. 17-19, 1912.

LOUISIANA ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, W. H. Bower Spangenberg, 625 Poydras St., New Orleans, La. Meets second Thursday of each month.

MAINE ELECTRIC ASSOCIATION. Secretary, Walter S. Wyman, Waterville, Maine.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary, E. F. Strong, Chaska, Minn. Sixth annual convention, March 15-22, 1913.

MISSOURI ELECTRIC, GAS, STREET RAILWAY & WATER WORKS ASSOCIATION. Secretary-Treasurer, P. W. Markham, Brookfield, Mo. Next convention at Mexico, Mo., 1913.

NATIONAL ARM, PIN & BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL DISTRICT HEATING ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 41 Martin Building, Utica, N. Y.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Executive Secretary, T. C. Martin, Engineering Societies Building, 33 West 39th St., New York.

NATIONAL ELECTRIC LIGHT ASSOCIATION, CANADIAN SECTION. Secretary, T. S. Young, 220 King St. West, Toronto, Can.

NATIONAL ELECTRIC LIGHT ASSOCIATION, COMMERCIAL SECTION. Secretary, E. L. Callahan, 29 West 39th St., New York.

NATIONAL ELECTRIC LIGHT ASSOCIATION, EASTERN NEW YORK SECTION. Secretary, R. H. Carlton, General Electric Company, Schenectady, N. Y.

NATIONAL ELECTRIC LIGHT ASSOCIATION, GEORGIA SECTION. Secretary-Treasurer, M. H. Hendle, Augusta, Ga.

NATIONAL ELECTRIC LIGHT ASSOCIATION, MICHIGAN SECTION. Secretary, Herbert Silvester, 18 Washington Boulevard, Detroit, Mich.

NATIONAL ELECTRIC LIGHT ASSOCIATION, MISSISSIPPI SECTION. Secretary, A. H. Jones, McComb City, Miss.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NEBRASKA SECTION. Secretary-Treasurer, S. J. Bell, David City, Neb.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NEW ENGLAND SECTION. Secretary, Miss O. A. Bursiel, 149 Tremont St., Boston, Mass. Fourth annual convention, Boston, Oct. 15-17.

NATIONAL ELECTRIC LIGHT ASSOCIATION, NORTHWEST SECTION. Secretary, N. W. Brockett, Pioneer Building, Seattle, Wash.

NATIONAL ELECTRIC LIGHT ASSOCIATION, HYDROELECTRIC AND POWER TRANSMISSION SECTION. Secretary, Farley Osgood, Public Service Electric Company, Newark, N. J.

NATIONAL ELECTRIC CREDIT ASSOCIATION. Secretary, Frederic P. Vose, 1343 Marquette Building, Chicago.

NATIONAL ELECTRICAL INSPECTORS' ASSOCIATION. Secretary, W. L. Smith, Concord, Mass.

NATIONAL FIRE PROTECTION ASSOCIATION. Secretary-Treasurer, Franklin H. Wentworth, 87 Milk St., Boston, Mass. Next annual meeting, New York, May 13-15, 1913.

NATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary-Treasurer, Richard Valentine, Janesville, Wis.

NEW ENGLAND ELECTRICAL CREDIT ASSOCIATION. Secretary, Alton F. Tupper, 60 State St., Boston, Mass. Directors meet first Wednesday of each month.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

New Orleans Electrical Contractors' Association. Secretary, S. J. Stewart, 312 Carondelet St., New Orleans, La. Meetings, second and fourth Tuesday of each month.

New York Electrical Credit Association (affiliated with the National Electrical Credit Association). Secretary, Franz Neilson, 80 Wall St., New York. Board of Directors meets second Thursday of each month.

New York Electrical Society. Secretary, G. H. Guy, Engineering Societies Building, 33 West 39th St., New York.

New York Electric Railway Association. Secretary, Charles C. Dietz, United Traction Company, Albany, N. Y.

Ohio Electric Light Association. Secretary, D. L. Gaskill, Greenville, Ohio.

Ohio Society of Mechanical, Electrical & Steam Engineers. Secretary, Prof. F. E. Sanborn, Ohio State University, Columbus, Ohio. Annual meeting, Akron, Ohio, Nov. 21 and 22, 1912.

Pennsylvania Electric Association (State Section N. E. L. A.). Secretary-Treasurer, Walter E. Long, 1000 Chestnut St., Philadelphia, Pa.

Pittsburgh Electrical Booster Club. Recording Watt, George H. Criss, 1806 Union Bank Building, Pittsburgh, Pa. Meeting, first Monday each month.

Railway Signal Association. Secretary, C. E. Rosenberg, Bethlehem, Pa.

Rejuvenated Sons of Jove. Jupiter, R. L. Jaynes, Pittsburgh, Pa.; Mercury (Secretary), E. C. Bennett, St. Louis, Mo.

Society for the Promotion of Engineering Education. Secretary, Prof. H. H. Norris, Cornell University, Ithaca, N. Y.

Southwestern Electrical & Gas Association. Secretary, H. S. Cooper, 405 Slaughter Building, Dallas, Texas.

Vermont Electrical Association. Secretary-Treasurer, A. B. Marsden, Manchester, Vt.

Western Association of Electrical Inspectors. Secretary, W. S. Boyd, 76 West Monroe St., Chicago, Ill. Convention, St. Louis, Mo., Jan. 28-30, 1913.

Western Society of Engineers. Electrical Section. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago. Regular meeting, fourth Monday of each month, except January, July and August. Annual meeting, Tuesday after Jan. 1 each year.

Wisconsin Electrical Association. Secretary, George Allison, Stephenson Building, Milwaukee, Wis.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED SEPT. 24, 1912.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,039,107. GOVERNING DEVICE; W. W. Dean, North Ridgeville, Ohio. App. filed Aug. 16, 1911. Centrifugal governor for circuit controlling.

1,039,110. ELECTRIC MOTOR; H. I. Finch, St. Louis, Mo. App. filed April 15, 1911. Self-ventilating.

1,039,120. ELECTRIC SADIRON; L. E. Grubbs, Logansport, Ind. App. filed March 30, 1911. Resistance coil disposed in grooves.

1,039,129. DISCONNECTING ELECTRICAL SWITCH; D. G. Hooker, Farmington, Conn. App. filed Oct. 27, 1911. Blade switch with long operating handle for manhole box, etc.

1,039,135. PROCESS OF ELECTRIC WELDING; A. L. Johnson, Hamburg, N. Y. App. filed Sept. 29, 1911. Metal buttons are interposed between members to be welded.

1,039,137. PROCESS OF ELECTRIC WELDING; A. L. Johnson, Hamburg, N. Y. App. filed April 4, 1912. Tubular metal buttons and angular contact faces are interposed between the members to be welded.

1,039,138. PROCESS OF ELECTRIC WELDING; A. L. Johnson, Hamburg, N. Y. App. filed April 17, 1912. A welding piece is projected through one of the members to be welded and against the other.

1,039,139. SECTIONAL SERVICE BOARD; N. Joleen, Chicago, Ill. App. filed Oct. 30, 1911. Lock cabinet for electrical distribution.

1,039,142. ELECTRIC BURGLAR ALARM; T. W. Keenleyside, Bisbee, Ariz. App. filed April 15, 1912. Window contacts with a look-out device.

1,039,151. GOVERNOR; J. J. Lisch, Bellevue, Ky. App. filed Nov. 15, 1909. Automatic controller for fluid compressors.

1,039,156. PLUG SWITCH; J. J. Lyng, New York, N. Y. App. filed Nov. 18, 1909. Twin plug and jack for telephone switchboard.

1,039,162. ELECTRIC ARC LAMP; L. M. McBride, Denver, Col. App. filed Oct. 18, 1909. Feeding device for converging electrodes.

1,039,170. ELECTRIC CONTROLLER DEVICE; J. F. Miller and W. V. Turner, Edgewood, Pa. App. filed April 6, 1911. Slow-motion device for car-controller handle.

1,039,174. THERMOSTAT; E. Moss, Christchurch, New Zealand. App. filed June 24, 1909. Expansible liquid type.

1,039,197. VARIABLE-SPEED ELECTRIC GENERATOR; C. H. Roth and W. J. Warder, Jr., Chicago, Ill. App. filed Nov. 3, 1909. Centrifugal governor for car and windmill motor-generator sets.

1,039,247. ELECTRIC SIGNAL; C. V. Blake, Brookline, Mass. App. filed Feb. 29, 1912. Long-distance electric trolley systems. (Improvement on Patent No. 810,027.)

1,039,248. JUNCTION BOX; W. L. Bliss, Milwaukee, Wis. App. filed May 2, 1910. For protection against moisture, for instance on car roofs.

1,039,257. FUSED DISCONNECTING SWITCH; R. C. Cole, Hartford, Conn. App. filed April 23, 1912. Pivoted tubular fuse housing.

1,039,264. PNEUMATIC BLOW-OUT FOR ELECTRIC SWITCHES; E. H. Dewson, New York, N. Y. App. filed Oct. 13, 1905. For electric pump governor, etc.

1,039,266. DIAPHRAGM FOR ELECTROLYSIS; O. Dieffenbach, Darmstadt, Germany. App. filed July 1, 1911. Composed of cement and asbestos fiber.

1,039,272. SYSTEM FOR CONTROLLING ELECTRIC MOTORS AND THE LIKE FROM A DISTANCE; H. Gradenwitz, W. Vollbrecht and H. Levzow, Berlin, Germany. App. filed March 15, 1911. Telpherage system.

1,039,279. CONNECTOR; W. P. Hammond, Passaic, N. J. App. filed Oct. 12, 1911. Spring-pressed jaws for gripping a binding post.

1,039,298. STEP-BY-STEP INSULATION FOR ELECTRIC CONDUCTORS OR THE LIKE; K. Kurda, Charlottenburg, Germany. App. filed Aug. 20, 1907. Plurality of alternating layers of insulating and conducting material.

1,039,307. ARMATURE WINDING; J. F. McElroy, Albany, N. Y. App. filed Oct. 21, 1905. Special slotted core winding for multipolar machines.

1,039,324. ELECTRIC SIGNAL AND TRAIN CONTROL; J. H. Sanor and E. W. Coukel, Canton, Ohio. App. filed Nov. 27, 1911. For signaling and braking approaching trains.

1,039,346. TROLLEY POLE RETRIEVER; E. B. Wintrode (deceased), Los Angeles, Cal. App. filed April 13, 1911. Maximum pressure during maximum consumption.

1,039,361. CAR ATTACHMENT; E. E. Campbell, Tacoma, Wash. App. filed June 2, 1911. Gravity trolley retriever.

1,039,387. ALTERNATING-CURRENT METER; K. H. Gyr, Zug, Switzerland. App. filed May 12, 1909. Magnetic field of rotary disk type.

1,039,395. EXPULSION SWITCH; E. M. Hewlett, Schenectady, N. Y. App. filed May 21, 1906. Oil type with swinging contact.

1,039,410. TELEGRAPHIC INSTRUMENT; L. H. Jernigan, Sacramento, Cal. App. filed Feb. 23, 1912. Sending instrument with adjustable sounder.

1,039,415. PROCESS OF OXIDIZING OR REDUCING CHEMICAL SUBSTANCES BY WAY OF ELECTROLYSIS; G. Kolsky, New York, N. Y. App. filed Nov. 3, 1911. One electrode surrounds the other.

1,039,418. APPARATUS FOR CONTROLLING THE PASSAGE OF VEHICLES ALONG A RAILWAY; A. C. Livermore, Edgewood Park, Pa. App. filed Nov. 11, 1910. Switch-operating controller.

1,039,422. CONNECTOR FOR ELECTRIC CONDUCTORS; H. F. Maxim, Norfolk, Va. App. filed Aug. 4, 1911. Spring jaws for gripping wire.

1,039,424. CONNECTOR FOR ELECTRIC CONDUCTORS; H. F. Maxim, Norfolk, Va. App. filed May 20, 1911. Wire clip for battery terminal, etc.

1,039,443. TELEPHONIC TRANSMITTING APPLIANCE; J. K. Rhodes, Brooklyn, N. Y. App. filed April 6, 1912. To be attached to the clothing; for the deaf.

1,039,463. ELECTRICAL RESISTANCE; E. Thomson, Swampscott, Mass. App. filed Sept. 18, 1909. Silicon is fused with inert sand, etc.

1,039,465. GAS-STOVE LIGHTER; T. L. Wiese, Milwaukee, Wis. App. filed Oct. 25, 1911. Automatic pilot cut-out.

1,039,467. ELECTRICITY METER; G. M. Willis, Chicago, Ill. App. filed Jan. 10, 1908. Windings are inclosed by celluloid shell and air-gap.

1,039,502. TROLLEY RETRIEVER; R. R. Dunlop, Columbus, Ohio. App. filed Feb. 20, 1909. Automatic spring device.

1,039,522. ARC-LIGHT ELECTRODE; E. J. Guay, Lynn, Mass. App. filed May 22, 1911. Titanium, carbide, cerium fluoride, cryolite and carbon.

1,039,542. ELECTRICAL CONNECTOR; W. O. Kennington, Bloomfield, N. J. App. filed Oct. 10, 1911. Socket-connection for flexible conductor.

1,039,543. HIGH-TENSION MAGNETO-ELECTRIC MACHINE; W. O. Kennington, Bloomfield, N. J. App. filed Oct. 10, 1911. The armature has two maximum or sparking positions.

1,039,553. ELECTRIC CIGAR LIGHTER; J. Leveen and M. L. Ashbaugh, Anderson, Ind. App. filed Feb. 16, 1912. Ignitable dip and contacts.

1,039,568. MOTOR CONTROL; R. H. McLain, Schenectady, N. Y. App. filed Sept. 17, 1910. Control of shunt-wound motors by varying field strength.

1,039,577. SELF-COOLED TRANSFORMER; J. J. Mullen, St. Louis, Mo. App. filed Aug. 21, 1911. Air-cooled radiating members.

1,039,589. TROLLEY WHEELS; J. W. Pennell, Youngstown, Ohio. App. filed Aug. 24, 1910. Has lateral replacing wheels.

1,039,600. SAFETY SWITCH; H. B. Shreve, Chicago, Ill. App. filed May 26, 1910. For interlocking elevator gates, etc.

1,039,644. ELECTRIC PUSH-BUTTON SWITCH; J. Brunner, Oelenburg, Germany. App. filed Sept. 11, 1911. Two independent insulated receptacles filled with mercury.

1,039,656. CORDLESS JACK BOX; E. E. Dildine and J. A. Rugh, St. Paul, Minn. App. filed April 12, 1910. A plurality of jacks for association with plugs to interconnect various circuits.

1,039,657. APPARATUS FOR WINDING THE FILAMENTS OF INCANDESCENT ELECTRIC LAMPS ON THEIR SUPPORTS; G. Dobkevitch, Paris, France. App. filed April 30, 1912. Automatically measures the filament and provides the necessary slack.

1,039,667. EMERGENCY SIGNALING DEVICE FOR TELEPHONE-EXCHANGE SYSTEMS; I. D. Fellows, Syracuse, N. Y. App. filed Feb. 25, 1911. Alarm attachment for connection in the circuit.

1,039,670. ELECTRICAL ROSETTE; W. J. Gagnon, Bridgeport, Conn. App. filed June 25, 1908. Strain relief.